

THE
SURGICAL CLINICS
OF
NORTH AMERICA

FEBRUARY 1921
VOLUME 1 — NUMBER 1
PHILADELPHIA NUMBER

PHILADELPHIA AND LONDON
W B SAUNDERS COMPANY

Copyright 1921 by W. B. Saunders Company. All rights reserved.
Published bi-monthly (six numbers a year), by W. B. Saunders Company, 529 North
Second Street, Philadelphia.
Printed in America.

CONTRIBUTORS TO THIS NUMBER

- ANTLEY P. C. ARTHURST, M. D. Associate in Surgery, University of Pennsylvania, Surgeon to the Episcopal Hospital and to the Philadelphia Orthopaedic Hospital and Laboratory for Nervous Diseases.
- JOHN G. CLARK, M. D. Professor of Gynecology, University of Pennsylvania, Gynecologist, University Hospital.
- J. CHALMERS DA COSTA, M. D., Samuel D. Owen Professor of Surgery, Jefferson Medical College, Surgeon to the Jefferson Medical College Hospital, Surgeon to St. Joseph Hospital.
- JOHN B. DEEVER, M. D. John E. B. Barton Professor of Surgery, University of Pennsylvania, Surgeon in Chief, Lombard Hospital.
- CHARLES H. FRANKER, M. D., Professor of Clinical Surgery, University of Pennsylvania, Surgeon, University Hospital.
- JOHN H. GIBSON, M. D. Professor of Surgery, Jefferson Medical College, Surgeon to the Pennsylvania and Jefferson Hospitals.
- JOHN E. JOHNSON, M. D. Professor of Surgery, Graduate School of Medicine, University of Pennsylvania, Surgeon to the Presbyterian, the Children's, and the Bryn Mawr Hospitals, Consulting Surgeon to the Philadelphia Home for Incurables.
- WILLIAM WILLIAMS KERN, M. D. Emerson Professor of Surgery, Jefferson Medical College.
- GEORGE MULLER, M. D. Professor of Surgery, Graduate School, University of Pennsylvania, Surgeon to St. Agnes and Misericordia Hospitals.
- CHARLES KARRAU, M. D., Assistant Professor of Surgery, Jefferson Medical College, Assistant Surgeon, Jefferson Medical College Hospital, Surgeon to St. Joseph and Mount Moriah Hospitals, Chief Surgeon, Franklin Hospital.
- T. TURNER THOMAS, M. D. Associate in Surgery and Associate Professor of Applied Anatomy, University of Pennsylvania, Associate Professor, Surgery and Applied Anatomy in the Post-Graduate School of the University of Pennsylvania, Surgeon to the Philadelphia General Hospital, Surgeon-in-Chief to the Northeastern Hospital.

CONTENTS

	PAGE
Introduction by Dr. WILLIAM WILLIAMSON KEES	vi
Contributions by Dr. JOHN B. DARTER, <i>University of Pennsylvania and Lankenau Hospital</i>	
PANCREATITIS	
Obit of Dr. J. Chalmers DeCoster, <i>Jefferson Hospital</i>	37
HYDRAED OVARY OF THE LIVER.	39
PARITY. DURESS OF THE BOWEL (OUTSIDE DUCHENNE)	40
FRACTURE OF THE VAULT AND BASE OF THE SKULL. EAR OF THE DOME. LACERATION OF THE CORTEX AND HEMORRHAGE FROM THE POSTERIOR BRANCH OF THE MIDDLE MENINGEAL ARTERY	44
LETTERING EPICRITICISM MISPLACED FOR MENSTRUATION HEMORRHAGE	44
PULSATILE CENTRAL SARCOMA OF THE LOWER END OF THE HUMERUS	74
PERFORATE BROWNEANUS GANGLION	74
Obit of Dr. John G. Clark, <i>University Hospital</i>	
PROLAPSE UTERI. ULTIMATE RESULTS IN 99 CASES	7
Obit of Dr. Charles H. Frazier, <i>University Hospital</i>	
A CLINICAL LECTURE ON TROCHILAL NEURALGIA	101
Obit of Dr. Arthur F. C. Ashworth, <i>University Hospital</i>	
BOY'S INJURY OF THE RIGHT SHOULDER. RESECTION OF THE BRACHIAL PLEXUS	127
RESECTION OF THE TONGUE. OPEN RESECTION	133
RECURRENT POSTERIOR DYSLOCATION OF THE HIP FOLLOWING LEE WHITE PARALYSIS.	133
PARALYTIC VALGUS OF THE RIGHT FOOT. NO CALCANEAL VALGUS OF THE LEFT FOOT	5
CYSTIC OVARY	59
UMBILICAL HERNIA	61
WIDENING ANGIOPLASTY	6
HEMORRHOIDS	6
CELLULITIS OF ORGANS AND KIDNEY	175
OPEN RESECTION OF FRACTURE OF THE ORGANS (DISEASED)	175
NO CASES OF EFFUSION INTO BOTH EYES. OPEN SYMPLECTIC. THE OTHER HEMOPHILIA	79
Obit of Dr. John H. Gibson, <i>Franklin Hospital</i>	
ANOMALY OF THE BREAST FOR CARCINOMA. THE STYWARD INCIDENT	85
Obit of Dr. Charles F. Kneass, <i>Jefferson Hospital</i>	
EPIDERMALOMA OF THE LIP	7
Obit of Dr. T. T. Thomas, <i>University Hospital</i>	
A METHOD OF APPLYING EXTENSORS. THE PLASTER CAST. DEATH IN FRACTURES OF THE LEG	207
Obit of Dr. John H. Jenson, <i>Franklin Hospital</i>	
OLD FRACTURE OF THE PATELLA. TREATMENT BY OPEN OPERATION, WIRING OF THE FRAGMENTS, AND SUTURE OF THE PATELLA AND APONEUROSIS	125
ESOPHAGEAL TUBERCLE. PERFORAL VARIETY. OPERATION AND TRANSPLANTATION OF TUBERCLE IN THE LUNG	181
PRIMARY HEMANGIOMATOUS EMBRYOMATOUS OF THE SPLEEN. SPLENECTOMY	133
Obit of Dr. George F. Muller, <i>University Hospital</i>	
LONG EMBRYOMATOUS OF SCAPULA OF MANY YEARS' DURATION. RESECTION OF TUBER AND SCAPULA FOLLOWED BY LOCAL RADIATION	43
EMBRYOMATOUS OF SCAPULA AND LONG BONES (MULTIPLE CARCINOMATOUS EMBRYOMATOUS)	149
CHONDROSTOMA OF HORNED IN YOUNG BOY (DEVELOPMENTAL. EMBRYOMATOUS. RADIATION CARCINOMA)	23
MULTILOCULAR C. IN (ARABIANITIS) OF LOWER JAW TREATED BY SCALP RESECTION AND FOLLOWED BY CURE FOR PERIOD OF THREE YEARS	24

CONTRIBUTORS TO THIS NUMBER

- AFTLEY P. C. ARSHURST, M. D. Associate in Surgery, University of Pennsylvania, Surgeon to the Episcopal Hospital and to the Philadelphia Orthopaedic Hospital, and Lecturer for Nervous Diseases.
- JOSEPH G. CLARK, M. D. Professor of Gynecology, University of Pennsylvania; Gynecologist, University Hospital.
- J. CHALMERS DA COSTA, M. D. Stuart D. Green Professor of Surgery, Jefferson Medical College, Surgeon to the Jefferson Medical College Hospital, Surgeon to St. Joseph Hospital.
- JOHN B. DEAYER, M. D. John Rhoads Barton Professor of Surgery, University of Pennsylvania, Surgeon in Chief, Lankenau Hospital.
- CHARLES H. FRAXTER, M. D. Professor of Clinical Surgery, University of Pennsylvania, Surgeon, University Hospital.
- JOHN H. GIBSON, M. D. Professor of Surgery, Jefferson Medical College, Surgeon to the Pennsylvania and Jefferson Hospitals.
- JOHN H. JOHNSON, M. D. Professor of Surgery, Graduate School of Medicine, University of Pennsylvania, Surgeon to the Presbyterian, the Cheltenham, and the Bryn Mawr Hospitals, Consulting Surgeon to the Philadelphia Museum for Incurables.
- WILLIAM WILLIAM KECK, M. D. Executive Professor of Surgery, Jefferson Medical College.
- GEORGE MULLER, M. D. Professor of Surgery, Graduate School, University of Pennsylvania, Surgeon to St. Agnes and Massachusetts Hospitals.
- CHARLES F. KAMAU, M. D. Associate Professor of Surgery, Jefferson Medical College, Assistant Surgeon, Jefferson Medical College Hospital, Surgeon to St. Joseph and Mt. Zion Hospitals, Chief Surgeon, Philadelphia Hospital.
- T. TURNER THOMAS, M. D. Associate in Surgery and Associate Professor of Applied Anatomy, University of Pennsylvania, Associate Professor of Surgery and Applied Anatomy in the Post-Graduate School of the University of Pennsylvania, Surgeon to the Philadelphia General Hospital, Surgeon in Chief to the Northwestern Hospital.

CONTENTS

	AGE
Introduction by Dr. William Willsboro Koss	vi
Contributions by Dr. John B. Dwyer <i>University of Pennsylvania and Lehigh Hospital</i>	1
PACHYMENIA	
Office of Dr. J. Chalmers DeGruy, <i>Jefferson Hospital</i>	7
HYPEROSTOSES OF THE LARYNX	47
ALERT DISSEMINATION OF THE BONES (OSTEITIS DEFORMANS)	
FRACTURE OF THE V. ULN AND BASE OF THE SKULL. TENDR OF THE DURA, LACERATION OF THE CORTICAL AND HEMORRHOIDS FROM THE POSTERIOR BRANCH OF THE MIDDLE MENINGEAL ARTERY	49
LYMPHATIC ENDOCRANIAL MISTAKEN FOR MENINGEAL HEMORRHOIDS	65
FORMING A CHITRA. BACITRA OF THE LOWER END OF THE HUMERUS	67
FRAGILE SPONTANEOUS GASTROENTERO	7
Office of Dr. John G. Clark, <i>University Hospital</i>	
FRAGILE UTERI, ULTIMATE RESULT IN ON CANCER	77
Office of Dr. Charles H. Frazier, <i>University Hospital</i>	
A CLINICAL LECTURE ON TENDRITIAL NEURALGIA	81
Office of Dr. Arthur F. C. Ashkenaf, <i>Jefferson Hospital</i>	
ROCK INJURY OF THE RIGHT SHOULDER. KNEELER OF THE BRACHIAL PLEXUS	27
FRACTURE OF THE TONGUE OPEN RECURRENT	136
RECURRENT POSTERIOR DISLOCATION OF THE HIP FOLLOWING PONTILIS PAXAL, AND PARALYTIC VALGUS OF THE RIGHT FOOT, AND CALCANEALGIA OF THE LEFT FOOT	181
HYPER OSTO	59
OBSCURICAL BLENDA	
INCOMPLETE ABORTION	63
HEMORRHOIDS	7
CELLULITIS OF ORAL AND EYES	7
OPEN REDUCTION OF FRACTURE OF THE ORAL (DURAND)	7
TWO CASES OF EYE INTO BOTH EYES. ONE HYPERSTETIC THE OTHER HEMO-PHALLA	179
Office of Dr. John H. Gibbons, <i>Pennsylvania Hospital</i>	
AMPUTATION OF THE FEMUR FOR CARCINOMA, THE STIMANT LIGAMENT	184
Office of Dr. Charles F. Russell, <i>Jefferson Hospital</i>	
ENTHELOMA OF THE LIP	97
Office of Dr. T. T. Thomas, <i>University Hospital</i>	
METHOD OF APPLYING RECURRENT WITH PLASTER CAST. DEATH IN FRACTURE OF THE LIP	202
Office of Dr. John H. Jenson, <i>Pennsylvania Hospital</i>	
OLD FRACTURE OF THE PATELLA. TREATMENT BY OPEN OPERATION, WINDING OF THE FLEASMENTS, AND BUTONE OF THE PATELLA IN APPOSITION	223
ECTOPIC TENDRIL FEMORAL ARTERY. OPERATION AND IMPLANTATION OF ARTICLES IN THE BENTON	23
PRIMARY HEMAPHORISATION ENDOCRANIAL OF THE SPINER. SPLENTICITY	213
Office of Dr. George F. Muller, <i>University Hospital</i>	
LONG ENDOCRANIAL OF SCAPULA OF MANY YEARS' DURATION. RESECTION OF TUBER AND SCAPULA FOLLOWED BY LOCAL RESECTION	43
ENDOCRANIAL OF SCAPULA AND LONG BONES (MULTIPLE CARCINOMATOUS ENDOCRANIAL)	249
CARCINOMA-OSTEOMA OF HUMERUS IN YOUNG BOY (DEVELOPMENTAL ENDOCRANIAL RESECTION OF SCAPULA)	213
M. TROCCULAR OF (ARABANTYRON) OF LOWER JAW TREATED BY SCAPULA RESECTION AND	

INTRODUCTION TO THE SURGICAL CLINICS OF NORTH AMERICA

BY

W W KEEN M D LL D

EMERITUS PROFESSOR OF SURGERY JEFFERSON MEDICAL COLLEGE,
PHILADELPHIA

It is most appropriate that the initial volume of the "Surgical Clinics of North America" should be the Philadelphia number for Philadelphia was the first to employ this method of instruction in the Jefferson the University and the old Pennsylvania Hospital amphitheater. But how poorly equipped, even in my own day (1860-6...) was the clinical teacher. There were no real laboratories, no examination of the blood, no knowledge of its chemistry or its physics or of its thorough examination by the microscope. Did we use percussion and auscultation? Yes, but not with the refinements of today. No critical examination of the urine beyond the chemical test for albumin was made. Palpation. Yes, and often far more thorough than today. There were shrewd clinicians who learned by touch, sight, and hearing and not seldom also by smell, many facts of value which today are sometimes overlooked because of our too exclusive dependence on the laboratory to the detriment of our natural resources. Our senses have lost not a little skill for want of practice.

More lamentable still was the fact that the student—in those days there were no graduate students or graduate courses of instruction—only saw and heard the teacher. Never did a student touch, auscult or percuss a patient or look through a microscope. No medical school I think then owned even a sur-

gle microscope. Of course it was before the day of the ophthalmoscope the laryngoscope and the lhd. The wretched tubular vaginal speculum which many of my readers may even never have seen, was the only "scope we had. Soon afterward the bivalve speculum and the various scopes came in quick succession. Had I not been an office student of Brinton and DeCosta I should never have touched a patient and never looked through a microscope. Yet, in my very first lecture on surgery on the first day of the session I listened in a dazed way to statements about 'blood corpuscles, which I had never seen the serum of the blood of which I was wholly ignorant, the crassamentum and the 'buffy coat, words which reached my ears but not my mind.

What was still worse, all the sacred seven professors began at once to cram me in all the seven branches of medicine. What a Babel it was! Even the to me wholly new medical terms had little meaning until I looked them up in Dunglison's Dictionary. How much worse off were many of my fellow-students who had never studied Latin or Greek, chemistry or physics!

For clinical purposes one of the most important items is the personal history. After graduation I re-entered the army and was soon in contact again with Weir Mitchell's fertile brain. He taught me how to elicit—literally to dig up—the facts of the personal history as no one else ever did. A chance word which to many would have no special significance to him was an "open sesame" to a wholly new vista of phenomena. Those who recall his familiar talks to eager graduates who years later hung on his lips, at the Orthopedic Hospital and Infirmary for Nervous Diseases, will confirm what I have said.

As a rule, his diagnoses were only made after the most painstaking investigation but from time to time he would make a sudden, flashlike diagnosis by correlating the case in hand with earlier experiences—his own or of others—with which his memory was richly stored.

The chief value of the clinical studies in the series now begun will come to the general practitioner the 'family doctor. He is after all the backbone of the profession. It is for him

that Frank Billings has so earnestly and rightly pleaded (Jour. Amer. Med. Assoc. February 5 1921) Hampered too often by the necessity of constant and continuous practice for the support of his family instead of his going to the clinic, in this and the succeeding volumes, the clinic will come to him with but little expense in money and almost none in time. He will learn the latest means of diagnosis, sometimes requiring instruments and skill beyond his means and his knowledge (e. g. the cardiograph or technical chemical tests) But even then his horizon will be enlarged, and he will know where and from whom he can get help if need be. Moreover these lectures will disclose means and methods which he can use or can learn. Hard experiences have often developed in the rural practitioner a resourcefulness far beyond that of his city brother in whom it remains undeveloped because it is unnecessary.

The same may be said of the newer methods of treatment. Even in the city the practitioner may often be saved from the exploiting drug or serum or vaccine manufacturer because the clinician will tell him the truth as to the value or worthlessness of these exploited remedies and save him from therapeutic pitfalls. It is to be hoped that these clinical lectures will especially take up many of the common diseases and injuries, such as hemorrhoids, fractures of many individual bones with the end-results, syphilitic lesions, real and reliable serums and vaccines with the evidence for their wonderful results, etc.

The rare and curious cases will add from time to time by exciting interest, and occasionally by bringing up from the well of memory of the readers other similar but as yet unrecorded cases.

Many a good surgeon will be glad to learn from Frazer's paper the perfected and practically non-dangerous operation for the douloureux (the spelling and pronunciation of which by doctors often leave much to be desired) and from Gibbon's clinic the Stewart incision for amputation of the breast.

In an easy colloquial manner the clinician here and there will introduce a flash of humor or a choice bit of a quotation or an anecdote or a literary or classical allusion by which the

subject will be lifted out of the dull, prosaic routine of facts and figures and made interesting as well as instructive.

Surgical pathology bears so directly on surgical diagnosis, especially differential diagnosis, and surgical practice that surely it will not be neglected. Such a lecture as that on "Pathology of the Living" by Moynihan (*Brit. Med. Jour.* 1917 II, 1381) stimulates every man who ever operates, especially in any cavity of the body and such close, minute observations as appear in so many of Lister's clinical lectures compel one to do likewise, unless the reader lacks all ambition.

May I make here two pleas both addressed to the clinicians themselves and in the interest of their readers.

It is only a question of time when the Metric System in thermometers weights, and measures of length and capacity will surely be adopted. They are so far preferable, scientifically and practically to our Fahrenheit scale, and the absurd and variable English measures, that it is most desirable to diffuse this knowledge among the rank and file of the profession. I hope therefore that these metric scales will always be used by the various writers adding if they so desire, in parentheses the English equivalents.

Second I hope that my age and long personal experience will warrant my pleading with every author to use the purest and best English style. Only by reading with an eye always to style and by severe self-criticism can one reach this goal. My own rule in every paper I write is first to be sure that my facts are right, my reasoning logical my conclusions valid. Then finally I read over most carefully and usually more than once every word *solidly* with a view to its English style. And how often I catch myself lacking in clarity using too long sentences committing even grammatical blunders, or else a locution far inferior to one which now suggests itself to my mind. If possible I always like to lay my paper aside for a month or more,

A capital instance for imitation exists in Trevelyan "The American Revolution, so interesting and so almost invariably excellent in style. Gay little book, "Writing Through Reading" (Atlantic Monthly Press, Boston) I ha found most useful.

that Frank Billings has so earnestly and rightly pleaded (Jour Amer Med. Assoc. February 5 1921) Hampered too often by the necessity of constant and continuous practice for the support of his family instead of his going to the clinic, in this and the succeeding volumes, the clinic will come to him, with but little expense in money and almost none in time. He will learn the latest means of diagnosis, sometimes requiring instruments and skill beyond his means and his knowledge (e. g. the cardiograph or technical chemical tests) But even then his horizon will be enlarged, and he will know where and from whom he can get help if need be. Moreover these lectures will disclose means and methods which he can use or can learn. Hard experiences have often developed in the rural practitioner a resourcefulness far beyond that of his city brother in whom it remains undeveloped because it is unnecessary.

The same may be said of the newer methods of treatment. Even in the city the practitioner may often be saved from the exploiting drug or serum or vaccine manufacturer because the clinician will tell him the truth as to the value or worthlessness of these exploited remedies and save him from therapeutic pitfalls. It is to be hoped that these clinical lectures will especially take up many of the common diseases and injuries, such as hemorrhoids fractures of many individual bones, with the "end-results, syphilitic lesions real and reliable serums and vaccines with the evidence for their wonderful results, etc.

The rare and curious cases will end from time to time, by exciting interest, and occasionally by bringing up from the well of memory of the readers other similar but as yet unrecorded cases.

Many a good surgeon will be glad to learn from Frazer's paper the perfected and practically non-dangerous operation for the douloureux (the spelling and pronunciation of which by doctors often leave much to be desired) and from Gibbon's clinic the Stewart incision for amputation of the breast.

In an easy colloquial manner the clinician here and there will introduce a flash of humor or a choice bit of a quotation or an anecdote or a literary or classical allusion by which the

THE SURGICAL CLINICS OF NORTH AMERICA

Volume 1

CONTRIBUTION BY DR. JOHN B. DE WEE

UNIVERSITY OF PENNSYLVANIA AND LAUREL HILL

PANCREATITIS

The classical paper of Remakel Heller is one of the necessary stimulants to the study of pancreatic disease which up to that time, through its unknown histology and little consideration, looked, it is difficult to believe, at the importance of the pancreas in upper abdominal pathology is generally recognized. This can be explained to some extent by the absence of a clear-cut clinical picture such as we have, for example, for peptic ulcer, appendicitis, gall-stone disease etc. — a lack that is due to various circumstances principally developmental and anatomic. The pancreas stands in such close relationship to adjacent viscera that it is rarely diseased without involvement of neighbouring organs, or rather the pancreas generally becomes involved through some peripancreatic disturbance. In addition, the organ is not easily accessible and also has a varied and complex physiologic function. As a digestive apparatus its function may be at least partially assumed by some other organ, and its metabolic function also may be performed without giving any symptoms of impairment of the external secretions of the pancreas.

The developmental processes of the pancreas are important in the study of pancreatic disease. Briefly stated the pancreas arises by a succession of budlings originally springing from the primitive gut. Of this accretion of buds that finally merge together, the terminal ones form the acini while the rest form the duct system.

and then revise it anew. One thus reads it almost as if it had been written by some one else. His mind is fresh, untroubled from the network of the wellworn familiar phrases, and he always finds means to improve and polish his English.

I fear that some such compound nouns as 'heart disease' "brain tumor" and a few similar expressions are too deeply embedded in the language to uproot them but why add to them? Why not say "renal colic" instead of 'kidney colic,' "gastric ulcer" instead of 'stomach ulcer' "surgery of the lung or pulmonary surgery" instead of using such a dreadful term as 'lung surgery'? An adjective before the noun is good English style, albeit of Greek or Latin derivation, but the noun + noun is not in accord with the usage of our best writers, nor with the genesis of the English language. It is proper in German, where it often leads to nouns of preposterous length. Why be ungrammatical and insist on saying "data is" instead of "data are," data being the plural of datum?"

It is a pleasure to survey the constantly growing medical literature by our American colleagues. In value it is growing more and more indispensable for the practitioner who wishes to keep abreast of the times, be he American or European. Practically I have seen all of this luxuriant growth from Gross' *System of Surgery* (1859) down to the present time.

May it always grow in value and be dedicated solely to the cause of Scientific Truth.

WILLIAM WILLIAMS KERN

1729 CHESTNUT ST.
PHILADELPHIA
February 1921.

handle of a pistol. For purposes of anatomic description it is said to consist of a head neck body and tail.

The head of the pancreas is closely related to the duodenum whose curves and variations of position it follows. Its posterior surface, therefore, may be in relation to the vena cava, the right renal vein, the right renal artery or the right suprarenal body. The common bile-duct passes down a groove on the posterior surface beneath the upper part of the head and the duodenum. In about two-thirds of the cases the pancreatic portion of the common bile-duct is covered with pancreatic tissue. On the anterior surface of the gland the division between the head and the neck of the pancreas is marked by a groove through which passes the gastroduodenal branch of the hepatic artery. This portion is crossed by the transverse colon, above which is the pyloric end of the stomach and below which are the coils of the small intestine. The neck is grooved posteriorly by the portal vein, which is often entirely embedded in glandular tissue.

The body the triangular prismatic portion, of the pancreas extends transversely and slightly upward from the neck on the right to the tail on the left. Its posterior surface is flattened and retroperitoneal, and is connected by areolar tissue with the posterior abdominal wall, with the anterior aspect of the aorta, the left suprarenal gland, and left kidney. The splenic vessels also run across this surface of the pancreas, the artery to the left along its superior border and the vein behind the gland at a lower level than the artery.

The anterior surface points upward and forward and forms a large portion of the stomach bed. It is covered by peritoneum from the bursa omentalis, or lesser or gastrohepatic omentum, which separates the pancreas from the posterior surface of the stomach. On the anterior surface of the gland is also the tuber omentale, which represents the point at which the pancreas crosses the spinal column. The inferior surface of the pancreas points downward and forward. Its peritoneal layer is continuous with that of the lower layer of the transverse mesocolon. It is in contact with the duodenojejunal angle medially and with the jejunum laterally.

ducts of the gland. The anlagen of the pancreas are a dorsal, closely related to the stomach, and a ventral, to the ductus choledochus. Some authorities describe two ventral anlagen, one of which (the left) either disappears early or remains rudimentary. The latter has been explained as being represented by the aberrant pancreatic tissue—accessory pancreas—frequently encountered by the surgeon in the wall of the stomach or the intestine, and which is capable of becoming diseased independently or which may be mistaken for a neoplasm.

The two original systems usually anastomose within the gland, the ventral, at first the smaller of the two developing into the important duct of Wirsung, the main channel of discharge of the pancreatic secretion, while the dorsal becomes the minor



Fig. 1.—The development of the pancreas: *Dc*, Ductus choledochus; *va*, ventral anlage; *da*, dorsal anlage; *S*, stomach.

excretory duct of Santorini. The glandular tissue of the ventral anlage, on the other hand forms only a part of the head and the uncinate process of the pancreas, the greater portion of the gland being developed from the dorsal anlage. This rather complicated developmental process naturally leads to anomalies which will be considered later.

Anatomically the pancreas occupies a position in the abdominal cavity directly behind the stomach, lying transversely across the spinal column at the level of the first or the second lumbar vertebra. It is a grayish-white or pinkish, elongated gland, measuring from 15 to 20 or 30 cm. in length. In shape it is often compared to a hammer, a dog's tongue or the letter J placed horizontally with the hook downward to the left or to the

disturbances. The veins correspond in general with the arteries. They empty into the portal vein partly directly through its small branches on the posterior surface of the gland and partly by way of the splenic vein and the superior mesentery vein.

Within the gland the vessels anastomose in the interlobular spaces and in the lobes independently of the vessels supplying the excretory ducts. The main duct and its branches contain several small veins, while the islands of Langerhans are particularly well supplied with capillary and larger vessels.

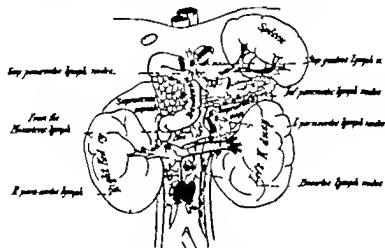


Fig. 2.—Regional lymph-nodes.

The pancreas has a peculiarly rich lymphatic system its vessels anastomosing freely with those of the duodenum and neighboring structures. Clinically this free communication is of importance in giving rise to the prepancreatic disease known as pancreatic lymphangitis the term originated by Arnsperger and adopted by myself and others.

The most comprehensive study of the lymphatics of the pancreas is that of Bartels. The pancreas has no single hilum so that the lymphatics, like the blood vessels, emerge at various points along the surface of the pancreas and run to the regional glands, to neighboring trunks, or plexuses. The regional glands

The tail of the pancreas is the blunt-pointed, upturned left end of the body in contact with the lower portion of the gastric aspect of the spleen, and below with the splenic flexure of the colon. Very often the splenic vessels cross from above in front of the tail of the pancreas on their way to join the spleen.

The greater part of the fully developed pancreas is retro-peritoneal, its connection with the posterior abdominal wall and neighboring structures taking place by means of the vessels and the surrounding areolar tissue. While these circumstances lend a certain degree of mobility to the pancreas, it is, on the whole,

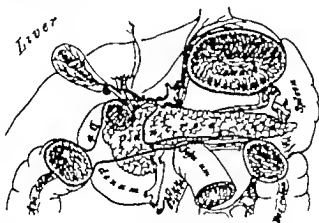


Fig. 2.—The relations of the pancreas, anterior view.

less movable than other viscera, and is, therefore, less liable to take part in general splanchnopleuritis. But I have at times been able to observe the head of the pancreas to be so movable that it could be brought well up in the wound.

The blood supply of the pancreas is derived from the hepatic branch of the celiac axis, the inferior pancreaticoduodenal branch of the superior mesenteric, the superior pancreaticoduodenal, a branch of the gastroduodenal artery, as well as from branches of the splenic and the hepatic arteries. The abundant arterial supply of the pancreas protects it against gangrene from occlusion, the necrosis of the organ being independent of circulatory

generally accompany the arteries, although some branches enter directly into the substance of the organ. Within the gland the nerve branches, composed mostly of non-medullated fibers, follow the arterial network, forming an interlobular plexus with numerous ganglia, and finally also surrounding the glandular acini.

In its minute anatomy the pancreas is an acinotubular gland composed of branching ducts and oval or rounded acini. The acini about the terminal ducts comprise the primary lobules, large numbers of which fuse to form larger secondary lobules. The lobules are held together by a connective tissue framework which is important owing to the changes it undergoes in chronic inflammation of the gland. A thin layer of connective tissue covers the surface of the gland (which is devoid of a capsule) while within the gland the connective tissue forms an interlobular and interacinous framework. The interacinous structure is peculiar to the pancreas. This consists of cells, known as the islands of Langerhans (named by the anatomist who first described these cells in 1869) usually located in the center of a lobule. They comprise the endocrine tissue of the gland, and are scattered throughout the greater part of the organ, although they are usually more numerous in the tail or splenic end than elsewhere in the gland. In the human system there seems to be no connection between the islands of Langerhans and the duct system of the gland. The function of these bodies is regarded as being concerned in metabolism of glucose derangement of which is the basis of diabetes mellitus. But neither their function nor their exact anatomic structure are as yet beyond the realm of controversy.

To the surgeon the duct system of the pancreas is of particular interest. This consists, as already mentioned of the main duct of Wirsung and the less important duct of Santorini. The duct of Wirsung begins by the union of small branches at the tail of the gland as a thin-walled whitish canal, increasing gradually in size as it passes from left to right through the body of the gland and downward and backward through the neck into the head of the pancreas. Here it lies near the posterior surface, and is in

of the pancreas are the pancreaticosplenic, the superior pancreatic, the superior gastric, the hepatic, pancreaticoduodenal, anterior and posterior the mesenteric, mesocolic, the inferior pancreatic, and the peri-aortic group of glands. To all of these the pancreas sends lymphatic branches which may anastomose in the cellular retroperitoneal tissues with the lymphatics from the stomach, duodenum, spleen, liver gall-bladder bile-ducts, colon, and even the left suprarenal body. The communication

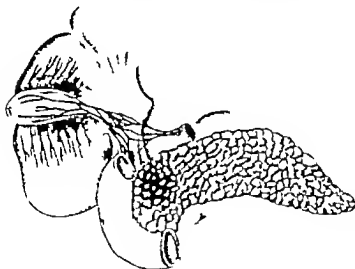


Fig. 4 —Lymphatic drainage from the gall-bladder toward the pancreas.

between the lymphatics of the duodenum and the head of the pancreas is particularly free. There is also a free anastomosis between the lymphatics of the gall-bladder and bile-duct and those of the pancreas, as demonstrated by Franke who succeeded in injecting the lymphatics of the upper part of the pancreas from the gall-bladder.

The pancreas derives its nerve supply from the sympathetic system, through the celiac ganglion (plexus solaris). The nerves

self-contained laboratory of physiologic chemistry. As an endocrine gland it elaborates an internal secretion essential to carbohydrate metabolism and probably also a second secretion needed for the absorbing function of the intestine. As an exocrine gland it elaborates the very powerful ferments, to the digestive activity of which the essential feature of pancreatitis in its acute (experimental or clinical) form are now recognized as being due. From the work of Bayliss and Starling we have learned that the most powerful stimulant to pancreatic activity

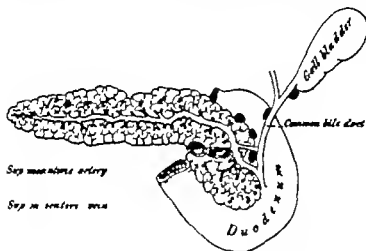


Fig. 6—The pancreas, its ducts, and their relation to the duodenum, from behind.

is not nervous, but chemical, in the shape of a hormone or messenger. This substance originates in the intestinal mucosa by the action of hydrochloric acid on a substance called prosecretin present in the cells of the mucosa of the duodenum and in the jejunum. The resulting substance—secretin—is then carried to the cells of the pancreas by the blood-stream.

The pancreatic juice, of which about 1500 c.c. are secreted daily, contains the proferments, which when activated are capable of breaking down the food proteins, fats, and starches into simpler substances capable of being absorbed directly or

relation to the common bile-duct, the two emptying side by side into the second portion of the duodenum below the pylorus. These two ducts then unite to form a common channel, the ampulla of Vater which through a small orifice opens into the duodenum. This orifice is the smallest part of the biliary canal. Oddi has described a thin layer of unstriated muscle-fiber around the ampulla and the ends of the ducts, which forms a sphincter known as the sphincter of Oddi, and which plays an important rôle in drainage of the bile-ducts.

The duct of Santorini drains a considerable part of the head of the pancreas. Near the neck of the gland it unites with the

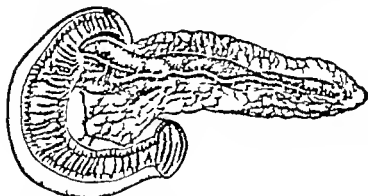


Fig. 3—The pancreas, its ducts, and their relation to the duodenum, anterior view. (From Deever and Ashurst "Surgery of the Upper Abdomen.")

larger duct of which it then appears to be a branch increasing in size as it approaches the duodenum, into which it normally empties.

The relation of the two pancreatic ducts, however, is subject to variations. They may fail to anastomose or they may be of the same size, or the duct of Santorini may be the larger of the two. Occasionally the duct of Wirsung may not be patent, but more frequently patency of the duct of Santorini is wanting or this duct may be so constructed that it cannot replace the function of its fellow duct in case of occlusion of the latter.

The pancreas has been well described by Sweet as a complete

direct methods consist of examining the duodenal contents, obtained either by artificial regurgitation of duodenal secretion into the stomach by injections of a large quantity of olive oil (Volhard) or by means of Einhorn's duodenal bucket. Of the two the latter seems to possess some degree of utility. But, on the whole, it may be said that although the approximate normal amount of the principal pancreatic ferments is known, the problem of correlating deviations from this normal with pancreatic disease is still unsolved.

The question of the pathogenesis of pancreatic disease has run the gamut of various theories, beginning with infection, retrojection of bile through impaction of a gall-stone in the ampulla of Vater retrojection of bile into the duct of Winsung caused by the contraction of the muscle of Oddi (Archibald) regurgitation of duodenal contents—swinging in a circle back to infection. While one or the other of these theories, all of which possess the one common feature of injury to the pancreatic tissues and activation of the pancreatic juice within the gland, may be applicable to certain cases there is a large class of cases falling outside of such effects and in which an infective process seems to play the chief part. This has been borne out by the observation made at the operating table, that most cases of chronic and subacute pancreatitis are associated with infections of the biliary tract and not a few with peptic ulcer or some other lesion of the gastro-intestinal tract, which produces a retroperitoneal inflammation. The problem in these cases, therefore, is reduced to the question of the route of infection. That this is by way of the lymphatics has frequently been pointed out in the joint works of Deaver and Pfeiffer. We were led to this conclusion by the observation so frequently made at the operating table that in those early cases of pancreatic diseases that are manifestly secondary to cholecystitis, it is chiefly the head of the pancreas (and often only its upper portion) that is involved. The fact that this is the portion furthest removed from the duct of Winsung, together with the fact that the rest of the gland in these cases is apparently normal certainly detracts from the theory of duct borne infection. On the other hand, not only are

undergoing further digestion by the succus entericus. These ferments are known as trypsin, lipase or steapsin, diastase or amylase and small amounts of maltase which converts maltose into glucose, and of nuclease which dissolves the nucleins. It is these ferments that are the active factors in producing certain diseases of the pancreas, particularly fat and hemorrhagic necrosis.

Unfortunately these serious phenomena associated with disturbed pancreatic function are not demonstrable except in advanced stages of pancreatic disease or at operation. But for certain kinds of functional derangement there exist some clinical manifestations of more or less diagnostic value and also some more or less reliable functional tests. The most familiar clinical sign is that of the large bulky fatty stools, which were observed and described by Bright as early as 1833 as *steatorrhea*. This, however even Bright recognized as an inconstant and not altogether reliable symptom, nor have any of the other clinical signs, such as the pupillary reaction of Loewi and others referable to the sympathetic nervous system, proved constant. The same may be said of Cambridge's chemical urinary reaction, which in my experience at least has failed to prove its worth. With the advance in the study of disease in general a number of clinical tests have been devised in the attempt to diagnose disturbances mainly of the external secretion of the pancreas. As far as the internal secretion is concerned it is now generally conceded that it is essential to carbohydrate metabolism and that when this is disturbed whether experimentally by pancreatectomy or clinically by derangement of the secretion, the result is glycosuria and diabetes.

Tests for the external secretion, that is, the presence and activity of the pancreatic ferments, may be indirect or direct. The indirect methods consist of introducing certain substances into the digestive tract which, unaffected by the gastric juice are acted upon by the pancreatic secretion and liberate certain substances which appear either in the urine or the stool. The two most popular tests of this kind are the guttoid capsule of Sahli and the gelodurat capsule of Muller and Schlecht. The

Once the pathologic ferment activity has begun, nothing more is needed to account for hemorrhagic and necrotic pancreatitis. Fat necrosis is the visible sign of activity of the fat splitting ferment, but it is the proteolytic process that sets free the poisonous products, which cause the severe and often fatal toxemia, a condition which bears the expressive name of *Pancreasvergiftung*.

ACUTE PANCREATITIS

Trypsin is one of the most powerful ferments elaborated within the body. As secreted within the gland it is inactive and is known as protrypsin, which is capable of being extra-vasated into the tissue cells without destructive effects, but when it becomes activated (that bacteria can activate trypsin has been satisfactorily demonstrated) its digestive action is seen in destruction of tissue cells, the delicate walls of the vessels of the pancreas and surrounding structures are injured, blood escapes and the result is an acute hemorrhagic pancreatitis.

By observation and inference the action of trypsin has also been tracked to the toxemia of intestinal obstruction. In this disorder Whipple and others have demonstrated the presence of a powerful toxin which presents all the characteristics of a primary protease, a substance which is one of the earliest decomposition products of protein when acted upon by trypsin. The resemblance of the toxemia of acute pancreatitis and high intestinal obstruction has also been observed by Sweet. It seems not unreasonable to assume that the toxemia in both conditions is identical and is, in all likelihood due to the toxic derivatives of the action of trypsin on protein material.

These hypotheses if they prove to be facts certainly would be of great value practically.

The casual observer is apt to limit acute disease of the pancreas to the conditions associated with fat necrosis and hemorrhage but the fact is that acute pancreatitis may occur without these phenomena as a simple non suppurative inflammation characterized by swelling edema, and possible tenderness at the site of the pancreas. While this type as seen at operation

the lymphatics known to be carriers *par excellence* of infection, but the peculiarly intimate relation existing between the lymphatics of the head of the pancreas and those of surrounding areas, so ably demonstrated by Bartels, lends strong support to our theory.

Although Bartels was acute enough to suggest the possibility of transmission of disease to the pancreas from the duodenum or adjacent viscera, it remained for Arnspenger to give the clinical evidence of this phenomenon, for which we have adopted his term "pancreatic lymphangitis" as descriptive of the origin and nature of this the most common inflammatory condition of the

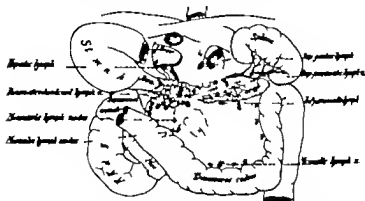


Fig. 7—Relation between lymphatics of the pancreas and those of surrounding areas.

gland. The sequence of events as repeatedly observed at operation and repeatedly reported by us is cholecystitis lymphangitis, lymphadenitis in the gastrohepatic omentum along the course of the cystic duct and the common duct peripancreatic lymphadenitis, pancreatic lymphangitis. Therefore as elsewhere in the body systems, treatment of the primary focus of infection is the rational step to pursue. This is all the more essential with regard to pancreatic disease, since there is every reason to assume that here more than elsewhere owing to the powerful pancreatic ferments the secondary effect are more serious than the primary infection.

deep incision. This was followed later on by enlargement and breaking down of both chains of inguinal lymphatic glands on the affected side. A short time after this the patient developed upper abdominal symptoms consisting of epigastric distress, jaundice, high temperature weakness, loss of weight. At this time I was called in. I ventured a diagnosis of pancreatitis (subacute). When I saw the patient a few weeks later he was

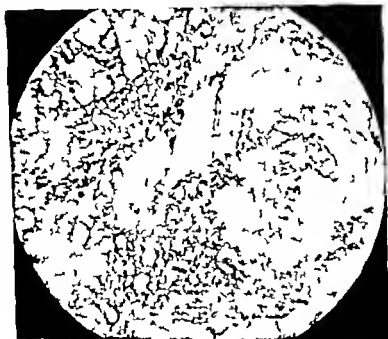


Fig. 9.—Hemorrhage and necrosis in acute pancreatitis.

desperately ill and delirious the jaundice and temperature persisting. He finally recovered from this attack and was able to resume work for a considerable period of time. He was then suddenly seized with an acute attack of upper abdominal pain, with collapse and all the signs of an intraperitoneal catastrophe, demanding immediate operation the patient succumbing at the operating table. The surgeon in charge afterward told me that

usually affects a part or the whole of the head of the organ, the inflammatory process may also be diffused throughout the gland. The fact that when thus diffused it is practically always accompanied by calculous or non-calculous cholecystitis, duodenal ulcer or duodenitis points to the possibility of a duct-borne infection, but in the majority of the cases no doubt the infection has traveled by way of the lymphatic channels

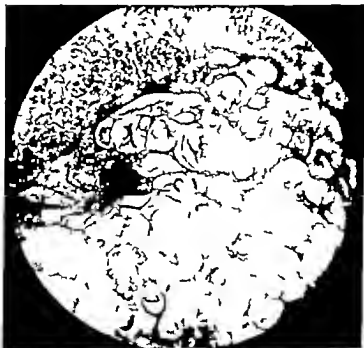


Fig. 8.—Fat necrosis.

Some years ago I was called in consultation in the case of a friend and colleague, a prominent surgeon of this city. He was suffering from an eczematous patch on the left leg above the malleolus. The condition was of long standing the patch had become infected, resulting in metastatic abscess on the inner anterior aspect of the thigh, and which required a wide and

of acute hemorrhagic pancreatitis, which clinically can be divided into ultra acute acute and subacute.

The ultra-acute, according to Mayo Robson's classification, is the one in which hemorrhage precedes inflammation and takes place within and without the gland.

The following case occurring in the Lankenau Hospital (reported by Dr Kroger at a meeting of the Philadelphia Academy of Surgery *Ann Surg* January 1921) is of interest particularly on account of its association with pregnancy a combination not often observed. The woman, aged twenty four years, was in the seventh month of a normal pregnancy. Two weeks before admission, following an automobile ride she developed generalized abdominal discomfort and general malaise. Two days before admission she was seized with a sudden gradually increasing pain in the left upper abdomen. In twelve hours the pain had become very acute, accompanied by continuous and profuse vomiting the vomitus at first being blood tinged (which the patient said may have come from the throat) and later dark green or brown, but without any fecal odor. No purgative was given, and enemas gave only slight results.

Past history unimportant. Menstrual history also negative. One child living and healthy.

Physical examination. Obese adult with cold clammy skin, and evidently in a state of shock. The pulse was weak running about 160 temperature 97° F respiration 36. Blood-pressure, systolic 96 diastolic 64. Face pale, tongue heavily coated. Head neck, lungs negative, also the heart, except for rapid rate. Abdomen distended with a pregnant uterus. There was moderate tenderness throughout the upper abdomen, especially to the left of the midline. No rigidity and no masses palpable. Peristalsis was diminished. Uterus hard, enlarged, slightly tender and freely movable. Vaginal examination negative. Extremities cold.

The blood count showed hemoglobin 80 per cent. red cells 5,000,000 white cells 30,000 polymorphonuclears 90 per cent. The urine contained a slight amount of acetone and diacetic acid and a few granular casts.

the abdominal cavity was filled with pus, and that the appendix was normal.

In the absence of autopsy of course nothing definite can be said with regard to the case, but my impression was strongly in favor of attributing the condition to retroperitoneal infection mainly by way of the peripancreatic and pancreatic lymphatics.

The possibility of a hematogenous infection has been demonstrated by reports of various observers, of pancreatitis occurring during the course of acute infections, such as scarlatina, scarlet fever and diphtheria. In fact, it is no exaggeration to state that such simple inflammation of the pancreas probably occurs more often as a more or less deferred sequel to scarlet fever than is generally recognized.

The pancreas is often called the salivary gland of the abdomen (well expressed by the term *Bauchspeicheldrüse*) and like the latter it seems to resist abscess formation, except as secondary to gangrene of the gland nevertheless primary suppurative pancreatitis is not unknown. We have observed at least three instances, one at operation and two postmortem. In the operative case a single abscess developed at the head of the pancreas in child during convalescence from acute appendicitis with peritonitis. In the postmortem cases the pancreatic abscesses were multiple and scattered throughout the pancreas, associated in one instance with pancreatic calculi and in the other with gall-stones impacted in the papilla of Vater. In the case of a single abscess occurring secondary to suppurative appendicitis, infection by way of the retroperitoneal lymphatics is a plausible explanation. In the other case duct obstruction is no doubt the responsible factor the underlying cause, in all likelihood being infection of the duct from the presence of the gall stone and the stasis thus produced. Whether in such instances the infection is carried along the duct or on its surface or in the subepithelial lymphatics makes very little difference.

Much more common than the phenomena just described are those generally referred to as hemorrhagic, gangrenous, and secondary suppurative, all of them in reality being grades

of acute hemorrhagic pancreatitis, which clinically can be divided into ultra-acute acute and subacute.

The ultra acute, according to Mayo Robson's classification, is the one in which hemorrhage precedes inflammation and takes place within and without the gland.

The following case occurring in the Lankenau Hospital (reported by Dr Kroger at a meeting of the Philadelphia Academy of Surgery *Ann Surg* January 1921) is of interest particularly on account of its association with pregnancy a combination not often observed. The woman, aged twenty four years, was in the seventh month of a normal pregnancy. Two weeks before admission following an automobile ride, she developed generalized abdominal discomfort and general malaise. Two days before admission she was seized with a sudden gradually increasing pain in the left upper abdomen. In twelve hours the pain had become very acute, accompanied by continuous and profuse vomiting the vomitus at first being blood tinged (which the patient said may have come from the throat) and later dark green or brown, but without any fecal odor. No purgative was given, and enemas gave only slight results.

Past history unimportant. Menstrual history also negative. One child living and healthy.

Physical examination. Obese adult with cold clammy skin, and evidently in a state of shock. The pulse was weak running about 160 temperature 97° F respiration 36. Blood-pressure, systolic 96 diastolic 64. Face pale, tongue heavily coated. Head neck, lungs negative, also the heart, except for rapid rate. Abdomen distended with a pregnant uterus. There was moderate tenderness throughout the upper abdomen, especially to the left of the midline. No rigidity and no masses palpable. Peristalsis was diminished. Uterus hard, enlarged, slightly tender and freely movable. Vaginal examination negative. Extremities cold.

The blood count showed hemoglobin 80 per cent. red cells 5,000,000 white cells 30,000 polymorphonuclears 90 per cent. The urine contained a slight amount of acetone and diacetic acid and a few granular casts.

The symptoms were suggestive of acute perforation of the stomach or the duodenum but the pregnancy so obscured the situation that a diagnosis was not possible.

About six hours after admission the patient developed severe pain in the lower abdomen, and suddenly aborted a dead fetus with the membranes intact. Following this she became progressively weaker temperature and pulse rose cyanosis set in, and death ensued twenty hours after admission.

At autopsy upon opening the abdomen, a considerable amount of the typical beef broth fluid of pancreatitis was noted. The stomach and upper intestines were dilated. The lower ileum was markedly constricted. Areas of fat necrosis were present on the omentum. The pancreas was acutely inflamed and almost totally destroyed by necrosis. The gall-bladder liver and other abdominal organs were apparently normal. The microscopic sections showed acute, suppurative, hemorrhagic pancreatitis and fat necrosis of the omentum.

The term "pancreatic apoplexy" has been applied to this form of non-inflammatory hemorrhagic pancreatitis. It is marked by sudden severe onset of pain, continuous vomiting shock, and profuse hemorrhage into the pancreas and its surroundings. Although the initial shock may sometimes abate somewhat, the disease is usually rapidly fatal, death occurring within three days. Autopsy reveals a completely infiltrated swollen pancreas with necrosis and gangrene more or less advanced, according to the duration of the attack. These cases fortunately are rare. Surgery may be attempted and is advocated by some even in the presence of profound shock, using saline and adrenalin before, during and if necessary after operation.

I doubt, however whether operation would save a case like the following Case No 3160/20 Patient male age forty eight years, admitted to the Lankenau Hospital in a state of collapse and with all the signs of an acute abdominal condition. He gave a history of having developed sudden severe abdominal pain and vomiting six days before admission. Supposing this to be acute indigestion due to a "squire" the night before he took a purge which acted well, but the pain continued, accom

panied by continuous vomiting, which was at no time fecal. He finally called in a physician, who at once sent him to the hospital.

Past medical history comprises indigestion and colicky pains for the past three years but no attack similar to the present one. Bowels constipated. Patient partakes freely of light wines and liquors. Denies venereal infection. Physical examination Adult male in a state of shock. Heart sounds barely audible. Abdomen slightly distended throughout and exquisitely tender to palpation. No rigidity. Peristalsis faintly audible. Temperature 101 F. Respiration 36. 200 c.c. of urine obtained by catheter. Stomach lavage yielded a dark brown, blood-stained fluid. Diagnosis Ruptured duodenal ulcer. Patient put on regulation. Died the following morning. At autopsy the appendix, duodenum and gall-bladder were found to be normal. The omentum was studded with small areas of fat necrosis later verified by microscopic section. The pancreas was soft, mushy and the seat of an acute hemorrhagic pancreatitis.

In acute, inflammatory hemorrhagic pancreatitis hemorrhage follows upon inflammation, it is less profuse and is distributed in foci throughout the gland. The general tendency of lesions of the pancreas to produce hemorrhage has already been alluded to. Hemorrhagic pancreatitis has been artificially produced in various ways, such as artificial ischemia, the injection into the duct of various substances—oil, hydrochloric acid intestinal secretion activated pancreatic juice etc.—the factor common to all these methods, as emphasized by Sweet's experimental studies, being the liberation of trypsin which causes the injury to the pancreas. Dr. Pfeiffer and myself have arrived at a similar conclusion based on anatomic and physiologic facts in conjunction with clinical observations.

Although fat necrosis and hemorrhage are not always present in acute pancreatitis, they generally play a very prominent part in the disease. The hemorrhage may be small or large, localized or diffuse, either in foci or involving the entire gland, or large hemorrhage may occur in the neighborhood of the gland and blood collect beneath the peritoneum, infiltrating the mesenteries

and omenta. In very severe cases a serosanguineous exudate is usually found in the peritoneal cavity.

Closely allied to the above is gangrenous pancreatitis. In this the hemorrhage, which is probably followed by necrosis involving blood-vessels, is often sudden and massive, involving all or part of the gland. The combination of the initial trauma and ferment activity leads to the death and sloughing of more or less extensive tissue, the prognosis depending on the extent of the process. Practically the entire pancreas is affected, presenting at once the picture of fatal *Pancreasvergiftung* in spite of all efforts to prevent its development. If the patient survives the immediate effects of the toxic process his life is still endangered by the presence of the gangrenous sloughing infected mass. Although this may possibly be relieved by drainage and sequestration the chances for recovery are slim in view of the essential structures involved and whose location makes drainage of exudates and sloughs difficult if not impossible.

A natural sequence of gangrene is the suppuration of the pancreas, that is, secondary suppurative pancreatitis as distinguished from primary abscess within the gland. In the cases that progress to this stage prognosis is somewhat brighter since the tissues become softened and disintegrate, and with the characteristic feature of pus to find an outlet there is a chance for the evacuation of the diseased process. General peritonitis may result, but the tendency is for the pus to localize. Abscesses may form in either loin or in the lesser peritoneal cavity; sometimes in the stomach and beneath the liver by way of the gastro-hepatic omentum or in the subdiaphragmatic space. These secondary collections may spread and increase rapidly or they may remain stationary, become encapsulated, and recede or they may increase slowly and develop into pseudocyst. Ulceration into adjacent viscera or into the general peritoneal cavity has been reported.

Of all acute abdominal seizures pancreatitis probably presents the most agonizing and dramatic syndrome and at the same time it is probably more rarely diagnosed before operation than any of the other acute abdominal conditions.

The difficulties of diagnosis are due to various causes. First, its comparative infrequency second the absence of a definite pathognomonic sign or symptom its frequent association with other severe abdominal lesions, and finally the desperate condition of the patient, which, particularly in the ultra-acute case, makes operation imperative without the formality of a diagnosis.

Diagnosis, as a rule is possible only if the patient is seen within at least thirty-six or forty-eight hours after onset. The seizure is sudden and frequently accompanied by collapse. The initial symptoms are pain vomiting rapid pulse and subnormal or normal temperature. The pain is agonizing at once and overwhelming more so even than that of a perforating viscus. It may arise in any part of the abdomen, but usually it starts deep in the epigastrium sometimes extending to the back and radiating to the chest and to the right or left hypochondrium.

The early subnormal or normal temperature is sufficiently constant to be of some diagnostic value in connection with the other symptoms. Later with the effects of infection, toxemia, and weakness, there is a rise in pulse and temperature increasing considerably in the terminal stage.

The vomiting is persistent, at first containing food and later becoming bilious in character. Fecal vomiting is unusual except as a result of paralytic ileus. It is then the usual regurgitant vomiting of advanced peritonitis, and portends death. Persistent hiccup is a frequent symptom and is also a fatal sign. Cyanosis of a peculiar yellowish hue has been noted on the face, over the abdomen, and over the rest of the body.

In one case seen twenty four hours after onset the presence of board-like rigidity led to a mistaken diagnosis of ruptured viscus. Marked rigidity may possibly be a very early symptom but, as a rule, when the surgeon first sees the case the rigidity is not marked. Tenderness at the left costovertebral angle is an important symptom, indicating the involvement of the body and the tail of the pancreas more especially the latter.

Distention is not so pronounced as in other acute abdominal crises, but at first is more marked in the upper part of the abdomen. Nor is rigidity marked. The bowels are generally

obstinately constipated although sometimes flatus is passed spontaneously or the bowels can be moved by enema sometimes diarrhea is present owing to the irritation of the pelvic colon and the rectum. The leukocyte count is high, but generally not so high as in other severe or high-grade infections. Polymorpho-nuclears are also increased.

With regard to the rôle of age and sex in the etiology of acute pancreatitis, it is commonly stated that the patient is usually a male in the third or fourth decade of life inclined to obesity and giving a previous history of digestive disturbance. This, however is subject to variations. In my experience in the Lankenau Hospital in a series of 15 cases (previously reported) the ages ranged from twenty-four to fifty-four years, and 11 of the cases were females. Under reports 16 per cent. females in a series of 33 cases. It is worthy of note also that acute pancreatitis not infrequently occurs shortly after childbirth.

In as overwhelming and dramatic a disease as acute pancreatitis there is considerable difficulty in establishing a very definite syndrome the signs are easily confused with acute intestinal obstruction, perforating peptic ulcer perforation of the gall-bladder or perforating appendix, acute cholecystitis, mesenteric thrombosis, etc. *The symptoms which distinguish pancreatitis from these conditions may be briefly summarized as sudden, overwhelming pain in an apparently healthy usually obese individual, incessant vomiting subnormal temperature, weak pulse, upper abdominal distention, transverse resistance not easily elicited, collapse and a peculiar cyanosis tumor in the epigastric region, or a mass in the loin. While differential diagnosis is important especially as it may influence the surgical incision, an error in diagnosis is not of vital moment in view of the fact that all of the above mentioned acute conditions demand early operation, when the correct surgical diagnosis of acute pancreatitis is easily made from the characteristic exudate and fat necrosis and the palpable enlargement of the pancreas.*

Recovery from acute pancreatitis without operation is not unknown. So-called pseudocysts of the pancreas are remnants of a previous pancreatitis postmortem evidence of previous

severe pancreatitis is also at hand. But it is safe to say that cases that recover by medical, that is, expectant treatment, would also recover by operative treatment while some of those that die without operation might have been saved had they been submitted to operation.

The surgery of the pancreas must be directed to providing an outlet for the toxic pancreatic fluid which has become activated as the result of injury either by infection by trauma, or by a chemically induced inflammation, or due to the irritating action of the dammed back bile. Instant drainage of the pancreas is the procedure indicated.

Resection of the pancreas is not as yet a practical measure. Any further surgery depends upon circumstances.

The condition of the patient permitting attention to the bile passages and the gall-bladder is not out of place. But it may be said in passing that in all likelihood attention to previous symptoms referable to these organs might have prevented the subsequent catastrophe. In a series of 18 cases of acute pancreatitis, gall-stones were present in 15. From this and other similar observations the conclusion is almost inevitable that gall-stones are responsible for a large percentage of cases. Dealing with the gall-bladder and bile passages should form part of the operation whenever possible. In this same series the gall-bladder was drained in 11 cases—with 3 deaths—in 2 the gall-bladder and the common bile-duct were drained both patients recovering and in 4 the operation was limited to the pancreas, the bile passages being untouched—3 of them recovered and 1 died. One patient died on the operating table before any surgery could be undertaken. Other associated conditions, if present, such as duodenal ulcer or duodenitis, cannot receive attention at this time. The essential thing is draining the toxins away from the pancreas. Pancreatostomy is beneficial if for no other reason than the relief of tension it affords.

The approach to the organ can be either a transperitoneal one or extraperitoneal through a loin incision. In case of abscess the latter allows approach to the pancreas, especially its tail without entering the peritoneal cavity but at the same time it has

the disadvantage of not permitting free exposure. It is feasible only in cases where the symptoms point to localization of the inflammatory exudate or the presence of pus in the loin, which is walled off by the abscess.

The transperitoneal route is the choice in beginning pancreatitis or when the diagnosis is doubtful. The doubt is generally soon dispelled by the presence of fat necrosis and the typical odorless beef broth fluid in the peritoneal cavity. The pancreas itself is reached through the gastrocolic omentum through the lesser omentum or through the transverse mesocolon. This permits of free exposure and adequate drainage—the latter a most important consideration. The advantages of the mesocolic route however are offset by the greater risk of contamination on account of the presence of the numerous coils of small bowel. In acute hemorrhagic pancreatitis the indicated procedure is to expose freely and drain freely. The question of the extent of incision or scarification of the organ itself is a delicate one. Too large an incision presents the risk of hemorrhage difficult to control. But scarification of the peritoneum over the gland should be sufficient to permit gauze drainage to be brought into direct contact with the surface this also opens up the retroperitoneal space and thus may help to prevent accumulation about the pancreas. A few blunt punctures of the pancreas may be of service in opening up the ducts and providing an outlet for the secretion. The most important item is arranging the gauze drainage as indicated above. One or more tubes should be included in the drainage. Both the tube and the gauze drainage should be conducted to the surface through an enveloping sheet of rubber-dam to reduce the chance of adhesions to the stomach and intestines, and render the subsequent removal of the gauze less painful. Free fluid in the peritoneal cavity must be removed as far as possible by gentle wiping and also by means of glass tube inserted in the pelvis through a stab wound above the pubis, since the pancreatic exudate itself contains sufficient toxic material to cause death. It is interesting in this connection to note that one of the first cases of recovery from acute pancreatitis was reported by Halsted who did

nothing more than sponge out the serosanguineous exudate. Other similar instances have since been reported but they are probably all of them mild cases unaccompanied by the extensive necrosis which constitutes the fatal toxemia of severe pancreatitis.

The gauze drainage should be allowed to remain until it comes away almost of itself of course, with proper precautions to prevent the damming back of exudate. Too early removal of the gauze may cause bleeding thrombosis, and spreading infection. On one occasion when I had the gauze removed too early there resulted such profuse hemorrhage as to threaten the life of the patient. The wound was then repacked and the gauze allowed to remain for two weeks.

The most serious danger during convalescence is secondary hemorrhage owing to the close relation of the pancreas to numerous large vessels and the erosive action of the exudate. This is a valid reason for limiting the incisions in and about the pancreas, and not overpacking with gauze. It is well known that necrosis of vessels is more likely to occur when in contact with drainage.

One of the most troublesome postoperative effects of drainage in acute pancreatitis is the formation of sinuses. The effect of the powerful pancreatic ferment on the tissues can be seen in the intensely irritated skin over which the discharge flows and in the sluggish manner of granulation subjected to the severe erosive action of the pancreatic fluid. For this reason the skin should be protected by a bland ointment to prevent contact with the secretions for once excoriations take place it is almost impossible to get anything to stick to the moist surface. A strict anti-diabetic diet is advisable and has been found useful in promoting healing.

CHRONIC PANCREATITIS

What has been said with regard to the difficulties of recognizing acute pancreatitis—absence of a definite syndrome and of entirely reliable clinical tests—applies as well to the disease in its chronic state. What has been gained from discussion and observation of pancreatitis has been the established fact that the pancreas is subject to chronic disease and that it plays an im-

portant rôle in the syndrome of certain digestive disturbances which have hitherto been referred entirely to adjacent viscera.

Chronic pancreatitis therefore, cannot be considered a rarity and the pancreas must enter into consideration in upper abdominal disease.

Chronic pancreatitis is generally considered as existing in two chief forms, one of which involves the interlobular septa and the parenchyma of external secretion, and the other attacks mainly the islands of Langerhans, and to a degree the secretory tubules and interlobular structures. The latter is the type associated with carbohydrate metabolism which in pronounced cases develops into diabetes. Interlobular pancreatitis, on the other hand is characterized by digestive disturbances.

Owing to the inaccessibility of the pancreas and the difficulty of observing the gradations from early lesions to late effects and also because of the scarcity of early material and the difficulty of studying the finer parenchymatous changes, due to the rapid self-digestion of the organ after death the chain in the pathologic process is still incomplete.

In the course of this discussion the rôle of disease of the lymphatics about the pancreas as the first stage of pancreatitis has been several times referred to. Reasoning along these lines, chronic pancreatitis may be classified as follows—chronic lymphangitic pancreatitis chronic interlobular pancreatitis chronic interacinar pancreatitis the last two (and cirrhosis of the pancreas, described by Robson) being the end-results of a pancreatitis.

Briefly stated the pathology of chronic interlobular pancreatitis consists of an increase in interlobular fibrous tissue with or without inflammation while in the interacinar type the increase of fibrous tissue insinuates itself between the acini, which become more or less distorted and degenerated. Intermediate states between the two also exist in which the fibrous tissue attacks the interlobular septa as well as the lobules and leads to chronic induration or cirrhosis of the pancreas.

But the primary factor in the production of these changes is, we believe an early inflammatory change without fibrosis, in

the form of a lymphangitis transmitted to the pancreas through infected neighboring structures. Accordingly infection carried by way of the lymphatics plays the most prominent rôle in the etiology of pancreatitis, although at the same time the possibility of other portals of entry is admitted the blood-stream the duct or ducts, and by direct contiguity



Fig. 10.—Inter- and intra-acinar chronic interstitial pancreatitis.

Although there is no reason why the infection cannot be carried to the pancreas by way of the blood-stream, the gland at least as far as clinical evidence is concerned, seems, as a rule, to be immune to the ordinary bacteremias.

On the other hand, duct-borne infection, through the duode-

portant rôle in the syndrome of certain digestive disturbances which have hitherto been referred entirely to adjacent viscera.

Chronic pancreatitis, therefore, cannot be considered a rarity and the pancreas must enter into consideration in upper abdominal disease.

Chronic pancreatitis is generally considered as existing in two chief forms, one of which involves the interlobular septa and the parenchyma of external secretion, and the other attacks mainly the islands of Langerhans, and to a degree the secretory tubules and interlobular structures. The latter is the type associated with carbohydrate metabolism which in pronounced cases develops into diabetes. Interlobular pancreatitis on the other hand is characterized by digestive disturbances.

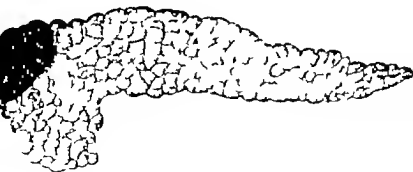
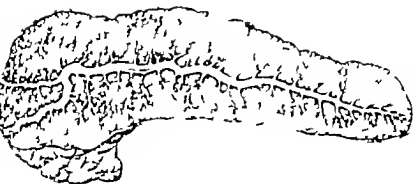
Owing to the inaccessibility of the pancreas and the difficulty of observing the gradations from early lesions to late effects, and also because of the scarcity of early material and the difficulty of studying the finer parenchymatous changes, due to the rapid self-digestion of the organ after death, the chain in the pathologic process is still incomplete.

In the course of this discussion the rôle of disease of the lymphatics about the pancreas as the first stage of pancreatitis has been several times referred to. Reasoning along these lines, chronic pancreatitis may be classified as follows—chronic lymphangitic pancreatitis chronic interlobular pancreatitis chronic interacinar pancreatitis, the last two (and cirrhosis of the pancreas, described by Robson) being the end-results of a pancreatitis.

Briefly stated, the pathology of chronic interlobular pancreatitis consists of an increase in interlobular fibrous tissue, with or without inflammation while in the interacinar type the increase of fibrous tissue insinuates itself between the acini, which become more or less distorted and degenerated. Intermediate states between the two also exist, in which the fibrous tissue attacks the interlobular septa as well as the lobules, and leads to chronic induration or cirrhosis of the pancreas.

But the primary factor in the production of these changes is, we believe, an early inflammatory change without fibrosis in

PLATE I



Hardening of the head of the pancreas.

num or the common bile-duct, has generally been considered to be the route by which the pancreas most often becomes involved. While the close relationship of the pancreatic ducts to the duodenum and the common bile-duct, and the frequent association of biliary disease and chronic pancreatitis seem to support this view it does not accord with surgical experience.

If the infection were carried by way of the duct system we would naturally expect a diffuse pancreatitis—affecting the entire gland—but at operation we find that in most instances chronic pancreatitis is most frequently associated with inflammation of some other abdominal viscus, and that the diseased part of the gland—the head—is that which has a free lymphatic relationship with the affected viscus. The part of the head of the pancreas that is most often found diseased is known as the triangle of infection (Plate I) that is, the area between the ducts of Wirsung and of Santorini. Inference therefore would lead to the conclusion that chronic pancreatitis as it appears to the surgeon, is a retroperitoneal infection secondary to the more common forms of abdominal inflammation of the duodenum, the gall-bladder the pylorus, the appendix, and other parts of the intestinal tract, all of which are connected by a retroperitoneal chain of lymphatics.

Obstruction plays a very minor rôle in the more common type of chronic pancreatitis as seen at operation. At the same time some cases of chronic interlobular pancreatitis are due to obstruction, as from pancreatic calculi, biliary calculi in the duodenal portion of the common duct, neoplasms, inflammatory tumors, and cicatricial processes involving the duct.

As to the influence of sex and age in the incidence of chronic pancreatitis, we find it more prevalent among males (58 per cent. of our cases) and in the third to the fifth decades of life. A number of cases have been reported below and above these extremes.

From what has already been said the rôle of disease of other upper abdominal viscera in the etiology of pancreatitis is evident. Tuberculosis and alcoholism also sometimes must be taken into consideration, while direct trauma as an etiologic factor is aptly illustrated in the following case

No. 2964/20 Female, age thirty five years. Admitted 9/28/20 Discharged 12/23/20

History—Two years of periodic attacks of pain in upper right abdomen about two hours after eating Occasional vomiting of bile. No jaundice or clay-colored stools. Loss of weight—6 pounds in past six months symptoms also increasing in that time. Nervous.

Appendectomy two years ago (elsewhere)

Blood-pressure 116/79

Physical examination Slightly anemic adult. Head and neck negative. Heart, impaired muscle tone Lungs negative. Abdomen moderate tenderness over gall-bladder No definite masses felt. Extremities negative.

			Test meal	Fast meal
W B C.	= 12,500	Quantity	50	30
Polymorphonuclears =	56	Free HCl	5	39
		Total acidity	19	97

9/30/20 Operation An ulcer was found on the second portion of the duodenum Adhesions between the pancreas and the duodenum were separated the duodenum invaginated the head of the pancreas sewn over the duodenal stump A pylorotomy was done, including the ulcer and the operation completed by a posterior gastro-enterostomy The gall bladder in this case was normal.

Postoperative the patient ran an irregular temperature became restless and nervous and somewhat distended. Stools, per enema, were dark bulky and odorous. On the sixth day patient complained of severe pain in the left side and difficulty in breathing

10/15/20 Fluoroscopic examination The left diaphragm is fully 1 inch higher than the right, and is completely immobilized suggesting a secondary collection but no actual collection can be seen on account of the patient's size.

10/16/20 Operation Median incision revealed hemorrhagic pancreatitis with fat necrosis studding the pancreas and the omentum also plastic exudate and pus under the left lobe of

x-Ray Duodenal deformity and imperfect filling suggestive of duodenal ulcer except that peristalsis is subnormal.

10/4/20 Operation Duodenum and pylorus normal. Enlarged glands around pancreas. Pancreas hard, nodular indicating chronic pancreatitis. Adhesions to gall-bladder released. Common duct clear. Anastomosis made between gall-bladder and duodenum. Chronically diseased appendix removed by clamp and cautery. Stump inverted.

Drainage One piece of rubber-dam beneath enterostomy

Patient made an uneventful recovery and was discharged in good condition.

This patient reported in person to the Follow up Clinic three months after discharge. He appeared perfectly well, claimed never to have felt better in his life and had gained 11 pounds in weight.

The symptoms of the chronic disease are usually those of the associated lesion, especially of the biliary tract. In an analysis of 30 cases of pancreatitis operated on at the Lankenau Hospital, of Philadelphia, not associated with gall-stones, but one third of which gave evidence of gall-bladder inflammation, the symptoms, in the order of frequency were recurrent attacks of acute severe pain in the epigastrium and the right costal margin (with scattering instances of pain in the left costal margin, in the lumbar region, and general abdominal pain). The pain sometimes is referred to the right shoulder the back and occasionally the left shoulder. Referred pain, however is considerably less frequent than in cases complicated by biliary calculus. Next in frequency were jaundice, flatulency vomiting history of indigestion, colicky pain, and indigestion between attacks.

Gastric analysis showed subnormal acidity in about 84 per cent. of the cases in which the analysis was made. Jaundice when present is associated with the usual signs of obstruction to the flow of bile clay-colored stools, and bile in the blood-serum and urine. Glycosuria is noted in about 7 per cent. of our cases. According to Cambridge bile obstruction is not complete, a certain amount of bile reaches the intestine and can be recognized in the feces as stercobilin. As a rule, it may be said that jaundice

the liver Drainage Three small cigarette drains, two small rubber tubes, one rubber-dam, one piece of gauze.

The postoperative course after the second operation was not satisfactory Both pulse and temperature remained high, the patient complained of pain in the upper left abdomen, was generally weak, and showed little desire for nourishment. On the second day she developed severe pain in the left loin space and marked tenderness at the left costovertebral angle.

11/20/20 Third operation With the patient on the right side an incision was made into the left loin space. Foul creamy pus, also particles of pancreatic tissue exuded from the wound. The cavity was washed out with permanganate solution, and rubber tubes sewed in. There was no connection between the cavity and the original opening.

Recovery after this was uneventful. The patient was discharged two weeks later with a small drainage-tube still in the wound.

Primary uncomplicated chronic pancreatitis is not a very common occurrence, nor are its symptoms very well defined or exclusive of other conditions. In the following illustrative case the symptoms might suggest duodenal ulcer except that their duration and the number of attacks are less than are usual for ulcers.

No 3007/20. Male, aged thirty-nine years History of an attack one year ago of pain coming on about four hours after eating lasting about two days. Similar attack about four weeks ago, accompanied by nausea and vomiting Food and soda gave some relief. In neither of the attacks was there belching of gas or jaundice Loss of weight 7 pounds in past three years.

Physical examination Well-developed poorly nourished male. Details negative except for tenderness on deep palpation over umbilical region and localized points of tenderness to right, at fourth lumbar vertebra.

Urine and stool negative. No masses or organs palpable. Nothing obtained from test-meal.

chronic pancreatitis which I have later proved to be carcinoma and vice versa.

Unfortunately removal of a specimen of pancreatic tissue for the purpose of diagnosis by frozen section is fraught with too much risk of unpleasant consequences to make this convenient and reliable method of use in these cases.

In doubtful cases the patient should therefore be given the benefit of the doubt by draining the bile externally or into the duodenum stomach, or intestine.

From what we know of chronic pancreatic disease the inference is natural that its treatment is closely bound up with the treatment of the diseases with which it is usually associated which in turn, are practically always surgical diseases.

In a measure, therefore, preventive treatment is of importance. The liability of involvement of the pancreas in other diseases of the abdomen, particularly of the gall-bladder and bile passages, which do not yield promptly to medical treatment, is a strong argument in favor of early operation for these disorders. Like wise in the treatment of chronic pancreatitis itself once it is established, delayed operation is full of danger in view of the irremediable changes that may take place.

For the present we have no promising means of direct attack upon the organ, so that the surgical treatment of chronic pancreatitis becomes a question of the best treatment of the pathology of the biliary tract encountered at operation.

Every infection of the gall-bladder is an interstitial one and as such is chronic and persistent. The experience of return of symptoms after gall-bladder operation shows that such recurrences are more apt to take place after the conservative operation than after removal of the gall-bladder. It is for this reason that if the gall bladder is diseased I prefer to do a cholecystectomy and also if the disease of the pancreas is not so pronounced as to cause common duct obstruction. For the gall-bladder is so often the primary focus of infection and within its walls harbors pernicious bacteria, particularly streptococci, which cannot be eradicated by simple drainage. Where there is evidence of calculous obstruction of the common duct choledochostomy is indi-

per se is not an important feature of pancreatitis, its presence being nearly always due to an associated lesion of the bile passages. Nevertheless the observation has been made that obstruction of the common bile-duct by direct pressure, enlargement of part of the gland that surrounds the duct, does take place. Also some cases of chronic jaundice with an enlarged and sclerotic pancreas have cleared up by draining the gall-bladder either by *cholecystotomy* or by a *cholecystoduodenostomy* or anastomosis with the stomach or other section of intestine. Physical examination reveals tenderness in the right costal margin, and in a few instances in the epigastrium and in the left costal margin. Désjardins has described a *pointe pancréatique* presumably corresponding to the outlet of the duct of Wharton, located from 5 to 7 cm. from the umbilicus in a line running to the apex of the right axilla which, however is not of much diagnostic value.

Owing to its deep-seated location the pancreas is rarely palpable except in individuals with lax and thin abdominal walls, or perhaps under anesthesia.

As already stated pancreatic function may be disturbed without giving early signs of its derangement. The various tests for abnormal function and their value as suggestive or confirmatory evidence have already been referred to. The diagnosis of chronic pancreatitis, however mainly rests on the history of the patient together with the physical and clinical signs but in the majority of cases exploration alone will decide.

The differential diagnosis from other diseases of the upper abdomen must generally be made on the essential features of these possibilities, since as we have frequently stated, the pancreatic syndrome is not a definite one. At operation it is most important to distinguish between an advanced indurative pancreatitis and a malignancy of the head of the pancreas or of other adjacent viscera that may cause jaundice.

At the same time the differentiation between chronic inflammation and cancer of the head of the pancreas is a matter of great difficulty nay I might say it can rarely if ever be made. Even the most experienced surgeon has diagnosed cases as

for the cure of pancreatitis but he offers a somewhat different explanation of its beneficial effects. According to his hypothesis, most cases of pancreatitis when unassociated with gall-stones or cholecystic disease are due to the presence of bile in the pancreas. Normally the introduction of bile into the organ is prevented by the action of the sphincter of Oddi at the outlet of the common bile-duct. It is by spasm of this sphincter and the consequent rise of bile pressure in the bile tract that bile finds its way into the pancreas with a more or less severe pancreatitis as the result.

For this reason Archibald proposes cutting the muscle of Oddi in order to overcome the spasm and the pressure and to provide prolonged drainage.

Occasionally a choledochoduodenostomy or reconstruction of the common duct may be required but in most conditions which show no disease of the gall-bladder or of the bile-ducts, and in which there is no evidence of other primary foci of infection the biliary tract is the best avenue of approach to the pancreas and drainage by means of a cholecystostomy is the most promising medium of removing infection of the biliary tract (that may be present and not recognized) or otherwise favorably influence the pathologic process in the pancreas itself.

Peptic ulcers if present should of course, be treated at the same time, preferably by excision or where this is not feasible, by exclusion of the pylorus and a posterior gastro-enterostomy. The appendix also should be examined and the pelvic organs (in women) for the presence of inflammatory tissue, which should be removed.

The possibility of direct surgery of the pancreas has been demonstrated experimentally by Sweet and others but as yet it is of academic interest rather than of clinical value.

The practical value of a limited study of this kind is, I hope, to emphasize the importance of the pancreas as a digestive organ, and the necessity of considering it in the diagnosis and treatment of upper abdominal disease also the etiologic relationship of disease of adjacent viscera and pancreatitis and the possibility of preventive treatment of pancreatitis by early attention to these conditions.

cated together with removal of the calculi and the passing of a large probe into the duodenum to make sure that the opening is patulous and to secure full dilatation.

If however jaundice is present and cannot be attributed to stone obstruction, but is due to pancreatic pressure, it is best to provide for prolonged internal drainage by means of a cholecystoduodenostomy or as has been done by Kehr making an anastomosis with the stomach or with the jejunum brought up through the gastrocolic omentum as recommended by Ochsner or into the intestine lower down, according to circumstances and the judgment of the individual operator. Prolonged drainage can be provided by stitching the gall-bladder to the abdominal wall or the organ can be removed and drainage obtained by means of a T tube in the common duct, which can be kept in position for as long as may be desirable.

I have had a case in which after three operations upon the common duct for cicatricial stenosis and chronic pancreatitis a T-tube has been worn for two years with little if any discomfort and very little discharge. The patient refuses to have it removed for fear of a recurrence. Indeed one of my patients has worn a T tube for as long as four years.

Prolonged drainage for the cure of pancreatitis acts in two ways. By removing infection, it gives the pancreas a chance to throw off inflammation and secondly the relief of intraductal pressure (in cases where the pancreatic duct and the common bile-duct anastomose before discharging into the papilla of Vater) gives the pancreas the chance to recover itself. The ability of the pancreas to recover itself has been demonstrated by various authors—notably Korte. In 1895 he operated on a case in which fat necrosis and serousanguinous exudate were present. Not being as yet familiar with this chief characteristic of pancreatitis he closed the abdomen without attacking the pancreas. The following year he was called upon to operate on the same case for calculous obstruction of the common duct. The pancreas was examined and found to be entirely normal.

Archibald also advocates prolonged drainage either by a cholecystostomy or a choledochostomy, preferably the latter.

for the cure of pancreatitis, but he offers a somewhat different explanation of its beneficial effects. According to his hypothesis, most cases of pancreatitis when unassociated with gall-stones or cholecystic disease are due to the presence of bile in the pancreas. Normally the introduction of bile into the organ is prevented by the action of the sphincter of Oddi at the outlet of the common bile-duct. It is by spasm of this sphincter and the consequent rise of bile pressure in the bile tract that bile finds its way into the pancreas with a more or less severe pancreatitis as the result.

For this reason Archibald proposes cutting the muscle of Oddi in order to overcome the spasm and the pressure and to provide prolonged drainage.

Occasionally a choledochoduodenostomy or reconstruction of the common duct may be required but in most conditions which show no disease of the gall-bladder or of the bile-ducts, and in which there is no evidence of other primary foci of infection, the biliary tract is the best avenue of approach to the pancreas, and drainage by means of a cholecystostomy is the most promising medium of removing infection of the biliary tract (that may be present and not recognized) or otherwise favorably influence the pathologic process in the pancreas itself.

Peptic ulcers if present should of course be treated at the same time, preferably by excision or where this is not feasible, by exclusion of the pylorus and a posterior gastro-enterostomy. The appendix also should be examined and the pelvic organs (in women) for the presence of inflammatory tissue which should be removed.

The possibility of direct surgery of the pancreas has been demonstrated experimentally by Sweet and others, but as yet it is of academic interest rather than of clinical value.

The practical value of a limited study of this kind is I hope to emphasize the importance of the pancreas as a digestive organ, and the necessity of considering it in the diagnosis and treatment of upper abdominal disease also the etiologic relationship of disease of adjacent viscera and pancreatitis and the possibility of preventive treatment of pancreatitis by early attention to these conditions.

CLINIC OF DR J CHALMERS DACOSTA

JEFFERSON HOSPITAL

HYDATID CYST OF THE LIVER

THE patient I now present to you is a man twenty-eight years of age, a Greek by birth, who has been in this country for ten years. He has always worked about a restaurant, and of recent years has managed such an establishment. He has been a very healthy man for many years and has received no injury of which he has any recollection. About one year ago that is, nine years after his departure from Greece, he discovered a small lump in the right hypochondriac region. It was neither painful nor tender. It has increased gradually in size until it has attained the considerable dimensions that you now observe. During all this time there has been no pain, no tenderness, no indigestion, no diarrhea, no jaundice, in fact, there have been no symptoms at all. An interesting fact in this man's history is that he never eats meat. He lives entirely on vegetables, on peas and on fruit. He eats salad, water-cress, celery etc. and eats these things uncooked.

The lump in the right hypochondriac region projects distinctly forward and it is visible as well as palpable. It is hemispheric in outline, smooth to the touch, can be pushed back from the abdominal wall, and, therefore is not adherent to the parietes. It is dull on percussion, and the dullness is continuous with the dullness of the liver. Percussion does not give that purring vibration known as hydatid fremitus. There is an obscure but distinct sense of fluctuation. On deep inspiration the mass descends with the liver. The tympanitic note of the colon can be made out below the mass. There is no intestine in front of the mass.

This patient was referred to us by my colleague the Professor of Genito-urinary Surgery. The man was brought to his department under the belief that the condition involved the kidney. Obviously the mass is not an enlargement of the kidney. It cannot be felt at all in the loin. There is no dulness on percussing the lumbar region. There is no intestine in front of the mass, as there should be in a kidney enlargement. The hand in the loin cannot lift the abdominal mass. Pressure on the mass does not make it palpable in the loin. There is no ballottement as is common in kidney cases. We try to develop ballottement by giving a sudden push in the loin which causes a kidney tumor to move away from the fingers, and while the fingers are held in place the tumor drops back upon them again. I might add that there have been no symptoms of any sort pointing to the kidney and that the urine is perfectly normal. So we are satisfied that we are not dealing with a condition of renal enlargement.

In spite of its prominence to the eye the mass is not a growth of the abdominal parietes. The superficial parts of the abdominal wall are obviously perfectly normal and the mass does not move with the abdominal wall during respiration, but descends and ascends with the liver.

We can exclude distended gall-bladder as the trouble. There is no pain, and he has not had any pain. There is no tenderness or rigidity. There are no constitutional symptoms. An enlarged gall-bladder is usually a movable mass. The growth with which we are dealing cannot be moved from side to side and moves only with the liver. An enlarged gall-bladder if not fixed by adhesions, can be moved from side to side like a pendulum and can be pushed backward in many cases.

So we reach the conclusion that we are dealing with a cyst or new growth of some sort connected with the under surface and anterior margin of the liver. It is not a cancerous growth. It was detected more than a year ago. There is no cachexia. There has been no loss of flesh. There is no nodulation such as is the rule in cancer of the liver. The growth is smooth and hemispheric. Most cancers of the liver have numbers of nodules.

which can be felt through the wall of the belly and the entire liver is usually enlarged. The blood examination in this man shows that there is no distinct anemia and no loss of hemoglobin as there would be in cancer.

Are we by any possibility dealing with a gumma of the liver? This man denies syphilis and has a negative Wassermann reaction. In most cases tertiary syphilis of the liver causes irregular areas of inflammation in Glisson's capsule and also hepatic cirrhosis, but a large and solitary gumma can form and also small gummata. The situation of this growth is the common situation for a solitary gumma, that is the anterior part of the right lobe. A person with a solitary gumma after a time develops pain, often fever and perhaps jaundice. It is one of the causes of the mysterious fevers we encounter now and then in practice. This growth is altogether too large for a gumma. A gumma would have broken down long before it could have attained such a size.

There seems to be no other probable condition ordinarily encountered which we think of. It certainly is not a tumor of the mesentery, a tumor of the omentum or a tumor of the colon. The query is, What can it be? It might be a solitary cystic adenoma arising from the bile-ducts. Years ago I helped Professor Keen operate on such a case. Solitary adenoma is an extremely rare growth. We offer a diagnosis of this case with considerable hesitation because of the great rarity in this country of the disease we suppose to exist. I believe this is a hydatid cyst of the liver. It is one of those remarkable cystic formations that is due to the implantation in the liver of the tapeworm of the dog in a larval stage. We must not reject a diagnosis purely and solely because a condition is rare. In the first place the disease does occur in this country and probably more frequently than has been suspected. In the next place, the liver is the organ most liable to attack. In the third place the cyst that is formed in hydatid disease corresponds in character to the cyst which exists in this man. A hydatid cyst of the liver grows with moderate rapidity, is dull on percussion, fluctuates if near enough to the surface and if the walls are not too tense

If the walls are tense or far away there is elasticity rather than fluctuation. There may or may not be hydatid fremitus. The sign is a rare one. By this term we mean a curious vibration which is sometimes obtained when a part of a cyst is palpated or squeezed with one hand while another portion of the cyst is percussed with the fingers of the other hand. This hydatid purring can be imitated by laying three fingers lightly on a spiral sofa spring and tapping the spring with the middle finger.

In a great many cases of undoubted hydatid disease, hydatid fremitus, thrill, or purring is absent. When present it is supposed by many to be due to large daughter cysts knocking against the wall of the mother cyst. Its absence in nowise counts against the diagnosis. Santona's sign is absent. This sign is a short, booming sound obtained by placing the stethoscope over a portion of the cyst and percussing another portion. A very significant fact in favor of the diagnosis is, in the words of Rolleston, that "there are physical signs, but no symptoms. Hydatid diseases of the liver may cause symptoms when it presses upon the bile-ducts (jaundice) upon the portal vein (ascites) when it suppurates or when it ruptures. Here is a sac, certainly large enough to contain a quart or more of fluid and yet the man feels perfectly well looks perfectly well hasn't a trace of pain, a hint of indigestion, or the faintest hue of jaundice. There is no suggestion of any trouble but the presence of the lump. The blood examination of the patient shows 3 per cent. of eosinophils, not enough of these cells to point absolutely to parasitic disease. The spleen is not enlarged it often is in hydatid disease of the liver. There is no history of an attack of urticaria. Such an attack may occur during the existence of hydatid disease. I shall make no attempt to confirm or set aside the diagnosis by the dangerous procedure of tapping or aspiration.

In reading the history I called attention to the fact that this man is a vegetarian and lived on lettuce, celery, uncooked fruits and vegetables, and didn't eat any meat at all. Professor Dieulafoy has pointed out that vegetarians suffer from hydatid disease more commonly than do those more sensible persons

who eat the things nature intended for them. A vegetarian, when he is shown the teeth meant for tearing meat, assumes the position of Alphonso the Wise, of Castile that is, 'the world is a crank machine and the Almighty should have taken advice.

You may well ask me, Did this man bring the disease with him from Greece? It is not uncommon in certain parts of Europe. It is very uncommon in the United States. It is not possible that he could have brought it with him. He arrived here ten years ago. When we think of the usual moderately rapid growth of a hydatid cyst of the liver (it attains the size of a walnut in a few weeks) it is impossible to conceive that ten years could have been occupied by this mass in attaining its present size. The man acquired the disease in this country. He has acquired it either from infected water or from unwashed and uncooked fruits or vegetables, or other things contaminated by the eggs of the tapeworm of the dog. We will discuss in some detail the subject of hydatid cyst of the liver and will then proceed to perform the operation required by this case.

The tapeworm of the dog, of the wolf and of the jackal is the *Tania echinococcus*. It has a head and neck and three or four segments or proglottides of which the final one is the largest and is in a condition of maturity. The head has from thirty to forty hooks and four suckers and the last segment contains about five hundred mature eggs. It is the smallest tapeworm found in any domestic animal. Enormous numbers of them may live in the small intestine of the dog. If a man, a pig, a sheep or a ruminating animal swallows food or drinks fluid containing these eggs, the eggs are liberated in the stomach from the gravid tapeworm segment. The embryo or oncosphere which escapes from the egg has six hooks. The embryos pass into the intestine, penetrate the intestinal wall by boring, and reach the liver in all probability by way of the portal vein. On reaching the liver the parasite develops into the larval or bladder stage. A cyst begins to form, grows progressively and may attain a very large size. This is known as an echinococcus cyst or hydatid cyst. Both terms are bad. "Hydatid" is from the Greek word for a

vesicle of water. "Echinococcus" is from the Greek words for hedgehog and berry.

We are dealing here with the common form the unilocular cyst, and not with the rarer form the multilocular cyst. For the details of the formation of hydatid cysts I would refer you to some special treatise on parasitology for instance, the recent work of Rivas.

It is not only the liver which may become the seat of a hydatid cyst. Years ago Huber of Bavaria, stated in the Twentieth Century Practice that the parasite is a cosmopolitan in the microcosm of the human body. It can settle, live, and prosper almost anywhere. In the liver the lung the bone the brain, the muscles (including the heart) the spleen, the kidney the prostate, the bladder the testicle, the female breast, the mesentery the great omentum the uterus, the ovary the mediastinum, the thyroid gland the lymphatics, the arteries, the spinal canal. It is met with most frequently in the liver—next in the lung.

The disease is known to be rare in America, although a number of cases have been reported. Probably a fourth or a third of our cases are in recent immigrants from Europe who brought the disease with them, but various reports from slaughter houses in the United States and Canada show that slaughtered animals are not very uncommonly affected with hydatid cysts, and such being the case there is in slaughter house refuse a fertile source for the propagation of the disease in this country. The disease is notably common in Iceland and very common in Australia. In Australia there are many times as many ruminant animals as there are men. In Iceland there are at least ten times as many sheep as there are men. In both countries there are great numbers of dogs.

Huber quotes Jonassen in emphasizing the danger that dogs may bring to man, and shows that a dog having thousands of tapeworms in his intestines passes each day numbers of ripe segments each one holding about five hundred eggs. The more careless and dirty a person is in handling dogs the greater is his danger. The acme of carelessness is met with in Iceland. The dog lives in the house in fact, in the kitchen and frequently

sleeps in the bed. There is no table and platters for eating are laid upon the floor or in front of the fire. Drinking water is kept very carelessly and Huber has told us that the method of washing dishes is to have the dogs lick them clean. He further shows that dried herring is a very common diet in Iceland. The food is eaten almost raw after having been placed upon a stone on the floor and beaten with a hammer. The stone is entirely accessible to the dogs.

The disease is quite common in some parts of Germany especially in Mecklenburg and is not uncommon in France in Italy and in Switzerland. In England it seems to be decidedly more common than here. Wherever it exists, if not brought from without we find the factors of the dog and flocks or herds, or adjacent slaughter houses. In our country it is held that a dog eats slaughter house refuse which contains the entrails of animals with hydatid disease. Suppose for instance that a dog was permitted at our clinic slop bucket after the performance of this operation for hydatid disease. As a result of eating the contaminated matter the dog could get tapeworm and the tapeworm of the dog can distribute the disease. One naturally feels like inquiring where it really started. It looks something like the old question, whether the egg came from the hen or the hen came from the egg. What is perfectly and immutably certain is this a dog with tapeworm is a source of great danger to other dogs and to man.

A dog's appetite like Sam Weller's knowledge of London is extensive and peculiar. When he is on a walk he takes, in the words of O Henry, 'a leisurely inventory' of a multitude of things. It is no safeguard to the dog to be a beribboned and perfumed fluff from a scented boudoir. His appetite is as debased and his habits are as bad as those of a mangy alley cur. If a dog acquires tapeworms he becomes a deadly menace. They may get upon food. They may get into drink. They may get upon the hand of one who pets and fondles the animal. They may be transferred by the dog kissing its mistress. I say its mistress because most such infatuates are females females who are so fond of dogs that they deny the existence of hydro-

phobia and, if they had heard about it, would deny the existence of hydatid disease. Such a person lives with a dog as a companion in bed and board talks to it, kisses it, and fondles it. Perhaps, like Madame DeStael, the more they see of men the better they like dogs, but I have always strongly suspected that they have seen so little of men that they think too much of dogs.

It is usually held that more women than men suffer from hydatid disease. The reason seems obvious. Over one-half the cases are between the ages of twenty and forty although the disease may occur in the early years of life or may not begin until extreme old age.

In some cases it seems as though traumatism had been a predisposing cause. This could only be by creating an area of least resistance. In some cases of hydatid cyst urticaria has occurred. In most cases when urticaria occurs the cyst has been tapped and there has been some leakage into the peritoneal cavity or the cyst has ruptured, but in some reported cases there seems to have been urticaria without leakage. A history of urticaria in association with the signs presented in this man would greatly strengthen a diagnosis of hydatid cyst. When a person with a hydatid cyst has had an attack of urticaria he seems to be immune to future attacks.

A hydatid cyst may keep on growing until it attains an enormous size, may eventually rupture externally into a body cavity into a canal or channel. For instance a hydatid cyst of the liver may rupture externally into the peritoneal cavity into the stomach, into the large intestine into the pleural sac, or into the inferior vena cava. Rupture externally may be followed by cure. Rupture into the peritoneal cavity is very dangerous to life, and even if the patient survives, it may be followed by the growth of hydatids in the peritoneum. Rupture into the vena cava is quickly fatal. Suppuration may occur in a cyst. Some hydatid cysts with death of the echinococcus go on to suppuration. Suppuration is set forth as one of the dangers following tapping. If tapping were done aseptically the danger would be trivial. The danger of tapping is leakage rather than suppuration. Suppuration may arise by infection

from adjacent intestine or may occur subsequently to necrosis of the cyst.

You observe in discussing the diagnosis of this case I did not advocate puncture or aspiration. It is true that the fluid if obtained might prove an aid to diagnosis. It has a significant chemical composition. It is a saline fluid with a specific gravity of 1.009 to 1.015 seldom contains albumin, contains at least 0.6 per cent. of chlorid of sodium very small amounts of phosphates, calcium and magnesium carbonate and sulphates, sometimes succinic acid sometimes uric acid and usually dextrose. The microscope may disclose scolices or hooklets in hydatid fluid but the fluid may fail to give us any certain information. In the fluid of a sterile cyst we will find no scolices or hooklets and in some cases the fluid contains pus or products of necrosis. I believe tapping to be not only uncertain and often useless but also a highly dangerous method, one always unjustifiable. The x-rays were used in this case and gave us some information. We have not employed serodiagnosis, as I have no knowledge of its status, and it seemed not worth while to delay to have it carried out. There is a precipitin test and a complement-fixation test.

We will now put this case to the final diagnostic test which is exploratory incision.

We make a free incision of the abdominal wall. This exposes the large cyst coming from the under surface of the liver. It is bluish yellow in color. Observe the gall-bladder upon it and in front of it. We make a coffer-dam of gauze about the cyst in case leaking should occur. The wound edges and the peritoneum must be protected from hydatid fluid because it might cause the growth of other cysts. We will now incise the capsule and try to enucleate the cyst proper without opening it. We have, against our wish broken into the cyst proper the fluid is pouring out, and we are glad of our packing. The fluid is light colored, look like typical hydatid fluid and contains many daughter cysts. I now enucleate the cyst from the capsule and find that part of the cyst wall is necrotic. The query we naturally make is Was the necrosis brought about by the x-ray? Frankly I don't know

The cyst contained almost 2 quarts of fluid. Numbers of daughter cells are floating in the fluid and many other daughter cysts are seen upon the walls of the enucleated cyst. Some of these daughter cysts are the size of acorns, others of pigeon eggs, others of walnuts. The connective-tissue capsule is now being sutured to the abdominal wall. Drainage of the cavity is necessary. The abdominal wound is now closed.

(The patient made an uneventful recovery. This is the fourth case that I have operated upon in the Jefferson Hospital in the course of thirty odd years. In one of these cases there was a huge hydatid of the muscles of the right thigh in another there was a cyst of the liver presenting in front another patient was suddenly seized with violent pain and jaundice and operation disclosed the fact that hydatid cyst had broken in the bile-ducts.)

PAGET'S DISEASE OF THE BONES (OSTEITIS DEFORMANS)

THE patient is a colored woman fifty two years of age, a native of Pennsylvania. She came to the hospital because of severe and persistent pain in the bones of the legs. Her father died of heart disease her mother of Bright's disease. One brother was killed by accident. One sister and two brothers are living and well. She has worked for many years at lace work. She had the ordinary diseases of childhood and inflammatory rheumatism in the ankles when a young girl. For six years she has been suffering from pain in the back. Her menses ceased six years ago. She had never had any miscarriages and has a child twenty five years of age who is in good health. She has never had venereal disease. Six years ago she began to suffer from aching in the bones of both legs. Neither of her parents and none of her grandparents suffered from anything similar. She has pain particularly when she walks. It is sharp in character and she suffers even when lying down. The pain is particularly bad just below the knees. The muscles of the lower extremities feel constantly tired. She is weak and can walk but a short distance without exhaustion.

On examination of the back she exhibits a cervicodorsal kyphosis. She has no pain in the arms. The head is obviously enlarged it being the shape of a triangle the base of the triangle being at the summit of the calvarium and the apex at the point of the chin. This enlargement is symmetric and is bony. The bones of the face show no enlargement. The chest is deformed by curving of the ribs. The bones of the legs particularly of the left leg are felt to be enlarged and so are the bones of the forearms. The Wasmann reaction is negative. The blood count shows a very moderate anemia, but is otherwise normal.

A guess at the diagnosis was hazarded from a mere glance at the head. This view was strengthened by the obvious thickening

The cyst contained almost 2 quarts of fluid. Numbers of daughter cells are floating in the fluid and many other daughter cysts are seen upon the walls of the evacuated cyst. Some of these daughter cysts are the size of acorns, others of pigeon eggs, others of walnuts. The connective tissue capsule is now being sutured to the abdominal wall. Drainage of the cavity is necessary. The abdominal wound is now closed.

(The patient made an uneventful recovery. This is the fourth case that I have operated upon in the Jefferson Hospital in the course of thirty odd years. In one of these cases there was a huge hydatid of the muscles of the right thigh. In another there was a cyst of the liver presenting in front. Another patient was suddenly seized with violent pain and jaundice and operation disclosed the fact that a hydatid cyst had broken in the bile ducts.)

tions of bone disease with deformity. For instance excessive callus, congenital deformity, bending of callus, bone syphilis and various rickety deformities. Paget restricted the term to a special disease, and to this it is now limited. Paget called it *osteitis deformans*. It is commonly called in honor of Sir



Fig. 12 —Paget disease of the bones

James Paget's disease of the bones. Don't forget to add of the bones to Paget disease otherwise the term could be confused with Paget's disease of the nipple and areola. It is a rare disease although I doubt if it is as rare as statistics indicate. Over 250 cases have been reported. The more carefully we are on a lookout for cases, the more of them we will discover

ing and curving of the tibiae and by the bone pains in the legs. x Ray examination confirms the diagnosis and shows typical bone changes in the skull the humeri, the bones of both forearms, both femora, the pelvis, the lumbar and dorsal spine, and the tibiae. The eye examination does not discover any signs of



Fig. 11 -Paget disease of the bones

pressure or atrophy. The urine is normal the heart is normal, and the temperature is normal.

□ We have here a characteristic example of that strange and interesting disease osteitis deformans, originally described by Sir James Paget in 1876. The name had been used by Czerny for a different condition as long ago as 1873. Before Paget's paper the term osteitis deformans was used for various condi-

Early in the disease the bone is so soft it can be cut with a knife although in certain regions and especially late in the disease it may become extremely hard. The marrow space is soon invaded and may become entirely obliterated. Von



Fig. 14.—Paget's disease of the bones.

Recklinghausen thinks that osteomalacia is the first change and that the bones bend because of the thinning of the bony cortex, and that inflammation arises in the region of osteomalacia and causes the formation of fibrous tissue. Certain it is that the first manifestation of the disease is bone absorption which causes

Many of them die of some intercurrent malady the disease never having been recognized. Many never come to the hospital at all. Sometimes cases are discovered they having come for advice for another trouble. For instance, Coppes, in the course of some years, found 4 cases of Paget's disease of the bones in an eye dispensary. In this as in nearly all cases, the original diagnosis was rheumatism. If a person is watchful



Fig. 19.—Skull in Paget's disease of the bones.

in walking about the poor and crowded neighborhood of a great city he will now and then see a case of Paget's disease usually in an elderly person who exhibits the attitude, the gait, and the enlargement of the head. Now and then the disease is discovered by the fact that the victim requires year after year a larger hat. Paget himself regarded the disease as chronic inflammation of the bone. So do many present-day observers. It certainly is neither neoplastic nor hypertrophic.

the hands of a giant, bent into a bow and then twisted. That body weight is not the sole cause of the bending is shown by the fact that the bones of the upper extremities also bend although to a less degree. The femur bends outward the tibia forward, the bones of the forearm backward. The changes of osteitis deformans are not osteo-arthritic although occasionally osteo-arthritis is seen as an attendant condition.

The bone changes usually begin in the bones of the legs, but may begin in the skull, in fact, in any bone. They start in one part of a bone, come to involve the entire bone other bones and eventually the whole skeleton. In some cases the condition remains long limited to one bone or even to an individual area of one bone. It may remain limited to one bone for years, and these cases are often very puzzling. In the great majority of cases a number of bones and finally practically all the bones become involved.

A characteristic feature of almost all cases is the enlargement of the skull. Some few cases never show it. These are undoubtedly cases in which we find no changes but in the skull. Most cases exhibit it sooner or later. In a number of cases it is the first sign observed, and in some few cases the skull is the only part affected perhaps for months and even years. It is true that the long bones of the extremities suffer far more often than the other bones, the tibiae being affected most commonly of all.

When the head alone is involved the question is: Are we dealing with leontiasis ossea (Virchow's disease)? Many observers regard this as a distinct disease limited to the face and cranium. Others consider it as a first stage of Paget's disease. In some cases of leontiasis ossea pagetic changes have afterward appeared in different parts of the skeleton. In cases of undoubted Paget's disease one side of the skull alone may be involved. Hence asymmetric deformity cannot be taken as a proof of Virchow's disease.

The bones of the hand and foot sometimes though uncommonly exhibit the changes of Paget's disease. In fact, the condition may begin there. The vertebrae are almost always in

enlargement of the Haversian canals. The next step is the formation of new osteoid tissue. In many of these cases there is wide-spread arteriosclerosis the nutrient arteries being also diseased. Locke has made a very clear statement of the essence of the process. He calls it a double one. First, old bone is absorbed second new osseous tissue is laid down. These two



FIG. 1 — Paget's disease of the bones.

processes go hand in hand although it seems highly probable that the resorption of old bone is the first step. Later new bone is deposited chiefly from the periosteum and to a slight degree from the medulla. The long bones of the extremities thicken and become the seats of pain. The bones of the lower extremities bend. This is partly due to the body weight. They do twist so that the femur comes to look as though it had been grasped by

the hands of a giant, bent into a bow and then twisted. That body weight is not the sole cause of the bending is shown by the fact that the bones of the upper extremities also bend although to a less degree. The femur bends outward the tibia forward, the bones of the forearm backward. The changes of osteitis deformans are not osteo-arthritic, although occasionally osteo-arthritis is seen as an attendant condition.

The bone changes usually begin in the bones of the legs, but may begin in the skull in fact, in any bone. They start in one part of a bone come to involve the entire bone other bones, and eventually the whole skeleton. In some cases the condition remains long limited to one bone or even to an individual area of one bone. It may remain limited to one bone for years and these cases are often very puzzling. In the great majority of cases a number of bones and finally practically all the bones become involved.

A characteristic feature of almost all cases is the enlargement of the skull. Some few cases never show it. These are undoubtedly cases in which we find no changes but in the skull. Most cases exhibit it sooner or later. In a number of cases it is the first sign observed, and in some few cases the skull is the only part affected, perhaps for months and even years. It is true that the long bones of the extremities suffer far more often than the other bones the tibiae being affected most commonly of all.

When the head alone is involved the question is, Are we dealing with leontiasis ossea (Virchow's disease)? Many observers regard this as a distinct disease limited to the face and cranium. Others consider it as a first stage of Paget's disease. In some cases of leontiasis ossea pagetic changes have afterward appeared in different parts of the skeleton. In cases of undoubted Paget's disease one side of the skull alone may be involved. Hence symmetric deformity cannot be taken as a proof of Virchow's disease.

The bones of the hand and foot sometimes, though uncommonly exhibit the changes of Paget's disease. In fact, the condition may begin there. The vertebrae are almost always in

involved producing a cervicodorsal kyphosis which greatly lessens the height of the individual. The lessening in height is accentuated by the bowing of the lower extremities. An individual may lose 6 8 10 or even 12 inches in height. One of Emerson's cases in Johns Hopkins shrunk a foot.

There is no known racial predisposition or immunity to this disease.

It most commonly begins about the age of fifty but it may start very much later or much earlier in life. In one reported case it was not observed until the age of seventy-nine. Cases have been reported as starting at the age of twelve thirteen, fourteen, and sixteen, and in a case of my own the disease began at the age of nineteen. Cases have been reported as having had the head enlargement ever since birth.

The disease is of very long duration, lasting for years. One reported case lasted fifty-two years. It doesn't tend directly to shorten life.

Males are somewhat more liable than females. There are many reported cases in which osteitis deformans seemed to be a family involvement, and I am convinced that Paget's disease is a family disease in many of the patients. Some observers believe that there is a pathologic causal influence in acquired syphilis. Most observers deny it. Four fifths of the cases, like this one, have a negative Wassermann reaction, and in some of the cases it was reported negative in the spinal fluid as well as the blood. In fact a consistent positive reaction has never been found in an uncomplicated case. The clinical history of most cases is decidedly against syphilis as cause and the administration of iodid has a particularly beneficial influence.

Some of the reports of the French school, notably those of Fournier and Lannelongue, assert that Paget's disease is late manifestation of inherited syphilis. They say that inherited syphilis and Paget's disease possess elements in common. Both prefer the long bones especially the tibia; in both the bone involvement is multiple; in both there is bone enlargement; in both there is prodromal pain; and in both there is deformity. The saber scabbard shin was described years ago by Fournier.

a lesion of inherited syphilis. In it the tibia is thickened in front and the crest is broadened from osteophytic growth, consequently the tibia becomes convex anteriorly. This seems to us a very different thing from the bowed tibia of Paget's disease. That Paget's disease has occurred in people with late hereditary syphilis is shown by a case reported by Fournier but that it was due to the syphilis seems very unlikely. As a matter of fact, a feeble Wassermann reaction should never be taken as a proof of syphilis. If we examine a number of persons certainly non-syphilitic 30 or 40 per cent. will give a feebly positive Wassermann reaction. We must conclude that there is no proof that syphilis, inherited or acquired is a cause. A neurotrophic cause is asserted by some. Degeneration of the nerves entering the nutrient foramina of bone is affirmed by others as causal. Gout, of course, has been blamed.

Several Italian scientists claim to have found a diplococcus in the bone and assert that they have found an identical diplococcus in the bone of osteomalacia. They prepared a vaccine and claim to have proved it serviceable. In 2 of my cases I removed a bit of bone from the tibia. Doctor Ellis made a careful study and found each piece of bone was sterile. Beyond the statement of the Italian scientists there seems to be no evidence that bacteria can be causal.

The popular and probable view is that increase, absence of or alteration in the character of the secretion of one or more of the ductless glands, is responsible for the metabolic changes characteristic of osteitis deformans. We know these glands have immense influence upon bone metabolism. We know that disease of the pituitary gland may be responsible for acromegaly, gigantism and the bone lesions of cretinism. We know that the thyroid gland influences growth and tissue construction. We believe in the dominance of the parathyroids over calcium metabolism. Until a better theory is presented we will assume disease of ductless gland or of ductless glands as the cause of Paget's disease.

In very great majority of the cases of Paget's disease the first symptom is pain in the legs. After lasting for some months

It may pass away. There may or may not be tenderness. The pain may be continuous or paroxysmal. It is aggravated by effort and may be so violent as to prevent walking. In some cases the pain has lasted throughout the whole course of the disease. Occasionally the leg pain is accentuated nocturnally. In a small minority of cases there has been no pain. The pain is particularly complained of in the lower extremities and not in the upper extremities or the head. The pain may appear *months before bone disease is observed*. It may not arise until the bone begins to bend. Severe pain will cause limping even before the onset of deformity. When the head is involved the deformity is striking and characteristic. The head becomes a triangle with the base above, when the enlargement is symmetric. The face is seldom affected below the supra-orbital margins, although the jaws sometimes suffer. Occasionally the enlargement of the head is asymmetric. The head may become enormous. The enlargement is due to immense thickening of the cranial bones. The greatest thickening is of the outer table, although the inner table thickens to some degree. Postmortem examinations show that the base of the skull also thickens and that the various foramina diminish in size. Changes in the bones of the base of the skull may produce pain and even palsy.

If there is great bony thickening of the face alone below the supra-orbital margins the condition is called *leontiasis ossea*. Such involvement of the face may cause severe pain and loss of function. In a case I saw in the Blockley Hospital blindness resulted.

The bones of the upper extremities may perhaps be involved early in the disease as early as the bones of the lower extremities, but in the upper extremity the disease is not noticed so soon, because of the usual absence of pain and the later advent and slighter degree of deformity. In a large majority of cases the disease begins in a bone or in bones of the lower extremity especially the tibia. There is first thickening and later bending. Usually one bone inaugurates the bending the tibia or the femur and other bones follow suit. Besides the *kyphosis* the chest is deformed and the pelvis broadened. The chest deformity

may be responsible for cough, chest pain, and dyspnea. The patient stoops and becomes very round shouldered. The head is jotted forward with the chin raised and it seems to be too heavy for its support. In a well-developed case as Paget pointed out, the chest is sunk toward the pelvis, the belly is pendulous, the curved lower extremities are held wide apart, the knees are bent, the ankles overhang and the toes are turned outward. The patient walks slowly and awkwardly in a tremulous and uncertain manner and requires the aid of a cane.

Fractures are uncommon, but occasionally occur. A fracture will undergo satisfactory repair. There seems rather a strong tendency to the development of sarcoma, probably because of the eccentric, inco-ordinate, and uncontrolled activities of the cells. Out of 159 collected cases of Paget's disease 15 showed multiple sarcoma.

Von Recklinghausen's disease (tumor-forming osteitis deformans, *osteitis fibrosa cystica*) was considered by its discoverer to be a definite malady although a near relative of Paget's disease. Other observers regard the two conditions as identical. Cystic fibrous osteitis arises more commonly in the young than does Paget's disease, a majority of cases being in the second decade of life. Over 70 per cent. of them occur before the thirtieth year. Most observers regard this condition as being in close connection with Paget's disease. Kollako considers fibrous osteitis and Paget's disease as identical. He says that in both bone marrow is transformed into fibrous tissue and in both there may be regressive changes leading to the formation of bone cysts or progressive changes resulting in giant-cell sarcoma. This view will be found in Ewing's masterly treatise on "Neoplastic Diseases."

The metabolic changes of Paget's disease, as set forth by my colleague Professor Hawk are of interest and probably of importance. They indicate a pronounced retention of calcium, magnesium and phosphorus and a large elimination of sulphur. It may be that during the formation of new bone the osteoid tissue produces a highly sulphurized organic matrix which is gradually calcified by the deposition of calcium, magnesium, and

phosphorus. In the course of the calcification a certain amount of the sulphur must be replaced by the other elements. Hence the retention of calcium magnesium and phosphorus, and the increased elimination of sulphur. This state of affairs is to a considerable extent the reverse of what we find in osteomalacia. Paget's disease is totally incurable. There is no proof of definite benefit from any plan of treatment. In some cases iodol seems to have somewhat mitigated the pains. In most cases it has done no good at all. It has been claimed that great pain in some of the long bones may be relieved by trephining the bone. I wouldn't hesitate to try the operation. An operation may be performed upon pagetic bones as on any other bone without any increased probability of infection and with equal certainty of sound repair. This statement is proved by the results of operations upon pagetic jaws.

We conclude that although Paget's disease appears to be a definite malady it has close relationship to osteomalacia and very close relationship to and perhaps identity with Von Reck Linghausen's disease, and with leontiasis ossea and hyperostosis cranii.

When the disease for a long period remains limited to one bone, it may be very confusing as in the reported case where it was limited to one bone for over six years. As a rule, after a few months other bones are found to be suffering. It tends to become irregularly symmetric, but is not always so and has nothing like the symmetric regularity of acromegaly. There is very curious reported case in which only one side of the body was involved.

The x-ray is of the very first importance in diagnosis. It demonstrates cases of Paget's disease long before the deformity appears. It identifies the characteristic changes going on in the bone. It makes the diagnosis from all other bone conditions. All patients with bone pains should have x-ray pictures taken.

I am of the opinion that the mystery of the origin and nature of Paget's disease of the bones has the most chance of solution by prosecuting and carrying out further studies of the metabolic changes and of the action of the endocrine

**FRACTURE OF THE VAULT AND BASE OF THE SKULL,
TEAR OF THE DURA, LACERATION OF THE COR
TEX, AND HEMORRHAGE FROM THE POSTERIOR
BRANCH OF THE MIDDLE MENINGEAL ARTERY**

THERE are only two possible opinions about the police force namely the opinion the public holds of the force and the opinion the force holds of itself. The public is not inclined to the view that policemen are qualified surgeons.

From the history of the patient before us we learn that some policemen regard themselves as surgeons. This case will illustrate the distinguished surgical abilities of our gifted police. Policemen have been taught just enough emergency surgery to make them presumptuous self-confident, and highly dangerous.

A little learning is a dangerous thing
Drink deep or touch not the Persian spring

The patient before you is a man thirty five years of age, an automobile mechanic by occupation. Several days ago he was found unconscious upon the pavement, was picked up by a policeman, and was taken to the station house. He recovered consciousness in a short while but was dazed. His answers were confused, he knew nothing of how, when, or where he was hurt, and had no memory of a period embracing a number of hours before the accident. There was no cut upon the scalp no epistaxis, no bleeding from either ear. He gave off a strong odor of liquor. That distinguished surgeon, the Sergeant of Police, made an examination and called in consultation that eminent diagnostician, the Lieutenant. Their views coincided and their diagnosis was 'pure drunkenness'. In a philanthropic spirit the police had the victim taken home. The next day my chief assistant, Doctor Shallow, was called in to see him. Doctor Shallow had him removed at once to the hospital, and later I

saw him. He was dull, heavy verging on stupor but not unconscious. The pupils were equal, normal in size, and reacted normally to light. The pulse was 60 and the respiration was normal. The arm and leg of the left side were weakened, but not absolutely paralyzed, and every now and then waves of tremor swept over them. In the course of a few hours these parts became the site of violent convulsive movements. The face was slightly but certainly drawn to the right. We believed we could feel a fracture of the parietal bone. The x-ray showed a fracture running from near the midline into the base of the right side. There was no hemorrhage from the nose, the nasopharynx or the ear and the ear examination showed there was no bulging of the drum, so we concluded that the basal fracture was not compound into the nasopharynx or the middle ear. Battle's sign was absent (ecchymosis over the mastoid process) and there was no subconjunctival hemorrhage. The eye examination showed some fulness of the retinal veins, but no choked disk. Spinal puncture showed some increased pressure and the cerebrospinal fluid was bloody. The pulse was 60 and the temperature was normal. It was evident that this man had a fracture of the vault of the skull which ran into the base, and that an injury to the brain had caused subdural hemorrhage and that he was slowly developing compression. The slow development of compression suggested a slow meningeal hemorrhage between the dura and the bone, a hemorrhage from a branch of the vessel rather than from the main trunk. Doctor Shallow trephined on the right side $1\frac{1}{2}$ inches back of the external angular process on a level with the roof of the orbit. He could see there a very thin edge of a clot which was extending forward from a considerable hemorrhage more posterior. The hemorrhage was not from the main trunk or the anterior branch of the middle meningeal. A piece of the inner table of the skull had been broken off had penetrated the dura and was ticking in the cortex, lesion responsible for the blood beneath the dura and perhaps for the spasm of the opposite side of the body. This piece of bone was removed. There was no active hemorrhage from the pia. The dura was sutured. Doctor Shallow

feeling that the thin edge of clot he saw was the anterior edge of a larger clot, proceeded to trephine below the parietal eminence in order to reach the posterior branch of the middle meningeal. There he found the source of the hemorrhage. A very large currant jelly clot was removed and the bleeding from the vessel was arrested by a piece of packing. This patient was laboring under a very slow meningeal hemorrhage. If such an amount of clot had formed quickly the man would have become comatose very soon, but as it formed slowly the brain had time to more or less adjust itself to the pressure, and heaviness and dulness had not yet given way to coma. Evidently had the surgeon not operated the bleeding would have continued, the clot would have enlarged, the pressure would have increased, the man would have become comatose and would have died of respiratory failure. The operation has undoubtedly saved his life.

You remember the typical course of a case of uncomplicated meningeal hemorrhage. The original injury the probable, although not necessary unconsciousness and the temporary nature of unconsciousness unless there are grave associated injuries. The fact that a definite period of consciousness intervened between an accident and the symptoms proper of a hemorrhage is of the very first importance in diagnosis. There is a gradual development of the symptoms of compression as I have outlined above. The original unconsciousness is due to concussion and the unconsciousness of concussion is always temporary unless there be grave associated injuries, like laceration of the brain, contusion of the brain, or profuse hemorrhage. The unconsciousness from pure concussion may last minutes or an hour or so but it is always transitory. The essential nature of the phenomena of pure concussion is that they are all transitory. The patient reacts from concussion and has an interval of consciousness until the gradual enlargement of the blood clot begins to cause compression. The interval of consciousness deceives many observers. It helped to deceive the police. The police regarded the smell of liquor on the breath as highly significant, but it is well to remember that a sleeping bishop

after a Christmas dinner might smell of liquor. Those of you who have read "Great Expectations" will remember that Joe Gargery, the blacksmith, knew this. Though perfectly sober he would run home from the tavern with his mouth open in the hope that the air would rinse out the smell before he reported to his formidable wife. Not unusually, a man who has been hurt has liquor given him as a restorative (or at least used to have before these moral days now upon us). This man was unconscious when found, so we admit that he had liquor before his accident. We don't know how much liquor. We don't know what his accident was. He might have fallen and struck his head. He may have been struck by one of the numerous desperadoes who at present infest Philadelphia with apparent immunity from capture. His loss of memory embracing a number of hours before the accident strengthened the police view as to drunkenness. They regarded the loss of memory as conclusive evidence of drunkenness.

A very common thing after a head injury is for a person to have some form of loss of memory. Memory consists of several elements—*viz.* perception, registration, reproduction, and localization in the past. These are the elements according to Ribot. If the image on the retina never reaches the brain center it is not perceived and what is not perceived cannot be registered. It is extremely uncommon for a person to remember an accident which renders him unconscious. The reason being that it is very unusual for registration to take place. The time between the accident and the unconsciousness is usually too brief to permit of it. If a person tells you he doesn't remember anything about the accident, and then afterward tells you he does remember about the accident, the latter statement is beyond any question a falsehood. It is quite impossible to recover memory which never existed and if the events of the accident were never registered, they can never be recollected. Reproduction means the bringing into consciousness of something that was registered and its localization in the past means the ability to tell whether the event was an hour ago, a week ago, a year ago, or years ago. A senile dement shows inability to localize in the

past. He mixes up the events of boyhood with the events of today. Inability to localize in the past means a useless memory. I have seen this form of amnesia follow a head injury. The loss of memory for a period preceding the accident means the inhibition of the reproduction of impressions, of things that have been registered. It is the common form of amnesia after a head injury. It may embrace minutes, hours, days, months, years or an entire lifetime. It is a condition that may be permanent, but in many of these cases a partial or complete memory is sooner or later recalled the inhibition upon the reproduction of registrations having ceased. It is therefore not at all unusual and not in any sense proof of drunkenness that this man smelt of whisky and that he had lost his memory of all occurrences during a number of hours before the accident. You can see that our patient has had a very narrow escape. If the police had followed the imperative orders of the Chief of Police Surgeon in regard to such cases they would have sent for the District Surgeon to come to the station house and examine the man. He would have recognized the gravity of the situation and have sent the patient to a hospital.

I cannot insist too strongly on the importance of this case. Once in a great while, I am ashamed to say a like piece of stupidity is exhibited in the accident room of a hospital. The resident physicians in our accident ward have imperative orders that a man who has struck upon his head or has been struck upon the head must not be allowed to leave the hospital for a day or two for fear that hemorrhage may be occurring or may subsequently occur. Such a happening in a police station is bad enough but in a hospital it would be an infinite disgrace. The man drunk or sober must not leave the hospital until we are sure that his condition is safe.

LETHARGIC ENCEPHALITIS MISTAKEN FOR MENINGEAL HEMORRHAGE

THE patient is a boy of twelve who was struck upon the head with a football two days ago. He was knocked down. Is said to have been unconscious for a minute or two. He got up feeling dazed and soon after went home. The next day the family noticed a difference in him. He didn't make any attempt to run out and play or see the other boys. He didn't want to talk. He had some headache and seemed very sleepy, constantly dropping off to sleep. Today he was brought here. He has a temperature of just below 101° F. His pulse is over 80 and soft. His pupils are equal, normal in size and contract to light. The eye ground when examined by the Professor of Ophthalmology was found to be normal. When shaken or pinched he can be roused to intelligence and will answer questions clearly, falling back at once into somnolence when the questioner ceases to interrogate. The legs show a slight tendency to Kernig sign but there is no Babinski reflex and no evidence of paralysis. A spinal tap shows no indications of pressure. The spinal fluid contained a normal amount of glucose but 80 lymphocytes to a field. A most significant thing is that when the boy is roused he complains of double vision, and the ophthalmologist reports to us that there is paralysis of the superior oblique in each eye—that is the muscle supplied by the fourth nerve. The Wassermann reaction is negative.

The significant facts in this case are that the boy after an injury developed lethargy, elevated temperature and ocular palsy without a sign of cerebral compression. The physician who first saw him, very naturally in view of the injury, believed that the boy was getting a meningeal hemorrhage, but there are no signs of compression. The cerebrospinal fluid is not ejected with force during the puncture. The pulse is not the pulse of compression and the condition is not one of stupor verging on

to coma but a condition of lethargy from which we can rouse him temporarily to full consciousness.

We regard the injury here as having been entirely casual or perhaps as having stirred into immediate activity organisms which were already present in the brain. We diagnose this case as lethargic encephalitis. It is a curious disease and is becoming not a very rare one. It is due to an inflammatory condition arising in the midbrain especially about the locus niger the gray matter of the Sylvian aqueduct and of the fourth ventricle, a process which may spread to the optic ophthalmi and the corpora striata, or to the pons varioli and the medulla oblongata. It might be said that the large number of cells in the spinal fluid sets aside this diagnosis. I do not think so. This case is tending to assume the meningeal form as shown by the slight Kernig's sign. In such a case there may be numerous lymphocytes.

It is not my province as Professor of Surgery to discuss the subject of lethargic encephalitis. That is done by my colleagues, the Professor of Practice of Medicine and the Professor of Neurology. I do want to say however that the triad of symptoms we have mentioned is most significant that is, lethargy ocular palsy and fever. Furthermore we should know that there are numerous different types of lethargic encephalitis, that one type is perhaps mistaken for brain tumor another type for brain abscess, another for uremia, another for diabetes, etc.

The essential character of the lethargy of encephalitis, the character which differentiates it from coma, is that the patient can be roused to answer questions intelligently and can be made to take food. Neither of these things is possible in coma.

It may have happened to others, but it is certainly new to me to have meningeal hemorrhage added to the various things with which lethargic encephalitis may be confused.

We refer this case to my colleague Professor Dercum.

(Professor Dercum tells me that the boy was treated by repeated spinal punctures. After the second tap the lymphocytes and the slight Kernig sign disappeared. In three weeks the boy was well.)

PULSATING CENTRAL SARCOMA OF THE LOWER END OF THE HUMERUS

THE patient is a man forty-six years of age, a street car conductor by occupation. Before the accident this man felt perfectly well and had not suffered from any pain in the extremity. About seven months ago while standing he was jolted and grasped the back of a seat with his left hand. His arm was violently wrenched and he also knocked his elbow. The doctor who examined him said that his arm was broken and put it up in splints. The doctor also said that he could feel crepitation when he pressed upon the part. An x-ray was taken, but it is said it failed to show a fracture. Whether it showed anything else we have not been able to find out. The splints were worn for several weeks and when they were removed the elbow was somewhat stiff. The man discovered a small tender lump on the inner side of the lower end of the humerus. This lump has grown progressively until it has attained the size that you now observe. It approaches the hemispheric in outline. It feels elastic, in fact, almost soft, and some parts of it are firmer than other parts. It pulsates distinctly. It is not the violent pulsation of an aneurysm of a large vessel, but a pulsation which is a sort of vibration or thrill. On listening with a stethoscope a blowing sound is heard. The skin over the mass is freely movable and exhibits some large veins. The mass itself is firmly attached to the bone and also to the fascia and muscle outside of the bone.

There is pain although no severe pain. On movement the part is somewhat tender. The x ray picture does not indicate any former state of fracture. It shows a central growth which has perforated its bony shell. It is possible to assume that when the doctor examined this man after the accident he felt the egg-shell crackling of this expanded bone over a tumor mass.

We are dealing here with a tumor of bone which either existed at the time of the accident or has resulted from trauma. The rapidity of growth, the condition of the bone, the great size of the mass, the pulsation, and the bruit all indicate that we are dealing with a malignant tumor. The first inquiry necessary to be made is whether the mass is a secondary or a primary tumor. Is there an seat of tumor growth in the body which might have been the source of such a secondary tumor? We know that cancer is never a primary disease of bone and that it attacks bone by infiltration (as when a breast cancer destroys the ribs or sternum) by lymphatic distribution (as when the head of the humerus becomes diseased secondarily to a breast



Fig. 16.—Palpable central sarcoma of the lower end of the humerus.

cancer) or by embolism. Cancer of the thyroid gland, of the prostate gland and of the mammary gland are particularly apt to cause secondary bone deposits. Cancer anywhere can be responsible.

Not uncommon fracture is the result of a secondary bone cancer. A number of bones are apt to be affected but one bone may suffer for considerable length of time. Cancer of the thyroid is particularly apt to cause bony deposit and if the thyroid growth is small it easily escape recognition. It is said that a thyroid deposit in bone may arise from small goiter. Such a deposit is apt to pulsate. A secondary hyponephroma may arise in bone and that it apt to pulsate. In

this case a careful examination fails to disclose any evidence of a primary focus which could furnish bone disease, as in the case before us

In order to be sure of our ground in reaching a diagnosis of primary tumor of bone the various bones of the skeleton should be studied with the x-ray. If we find multiple lesion the



Fig. 17.—Pulsating central sarcoma of the lower end of the humerus

hances are strongly against their being sarcoma (although they may be) and we would be in all probability dealing with that curious and fatal malady—multiple myeloma. In primary bone neoplasm the urine does not show Bence Jones albumin. In multiple myeloma it does show it. This form of albumin is not precipitated by nitric acid except after standing and a pre

calcinate thus formed is dissolved by boiling. We therefore conclude that we are dealing with a primary tumor of bone malignant in character hence with a sarcoma. It is a well-known fact that injury may be the exciting cause of sarcoma. Gross says there is a history of injury in half the cases (a blow, a fall, a twist, a wrench, a break, or a sprain). In other cases the first strong suggestion of a sarcoma may be a pathologic fracture or a fracture from slight force. This may occur in a periosteal sarcoma. It is particularly apt to occur in a central sarcoma. According to Bloodgood a studies pain is bound to precede spontaneous fracture in central sarcoma. This man had no pain before his accident. As the x-ray picture shows a central sarcoma, we assume either that the accident broke the thin bony shell of an existing tumor or that the traumatism inaugurated the tumor.

In this man there are no significant blood changes. There is no evidence of lymphatic involvement and we are dealing with a central tumor that has broken through its shell. Now what kind of tumor is it? Can it be a giant-cell growth, one of those growths which is practically benign and which is curable by a local operation. This growth is too rapid for a giant-cell sarcoma and Dr Bloodgood writes me in answer to a query that he had never seen pulsation in a central giant-cell sarcoma. He says he has seen it once in giant-cell sarcoma of the periosteum. Personally in my much smaller experience I have never seen pulsation in any periosteal sarcoma. We are dealing here evidently with a real malignant tumor—round cells, spindle cells, or perhaps mixed cells. The type of growth is what is commonly called a bone aneurysm and what Bloodgood well names a malignant bone cyst.

Sarcoma of bone is one of the most malignant of neoplasms and the records of operative treatment are truly ghastly although malignant bone cyst shows far better results than other forms. Bloodgood shows that amputation cures less than 4 per cent. of periosteal sarcomas, that the results are only somewhat better in central sarcoma than in malignant bone cyst practically one-third of the cases may be cured. The point that must

at once be determined in this man is whether or not there are pulmonary metastases. Sarcoma is distributed by the blood rather than by the lymph. Pulmonary metastasis occurs sooner or later in nearly all cases. Frequently it occurs very early. If metastasis exists, the patient is doomed. No treatment for it is of the slightest avail and it is simply mutilation to practice radical surgery for a sarcoma of the extremity if the lungs are already involved. We direct that this examination of the lungs be made at once.

Bloodgood in his classical study of 370 cases of bone sarcoma tells us that diagnosis is often more or less uncertain, that amputation must never be performed until a diagnosis of malignancy is established, and that an exploratory operation may be necessary to confirm the diagnosis. It might be possible in this case if pulmonary metastases are absent, to undertake an operation by resecting and bone-grafting. In the upper extremity this would be particularly worth trying but if it were found not to be possible amputation ought to be performed. So our future procedure is to be as follows:

First, the x-ray picture of the lungs. If the lungs are found clear from sarcomatous nodules, make an exploration of the tumor and remove a portion of tumor tissue for laboratory study. After the removal of this portion of tissue we will again follow Bloodgood's advice. We will cauterize the wound with the actual cautery or with a 50 per cent. solution of chlorid of zinc in order to kill aberrant cells and prevent rapid growth of the disease. If our diagnosis is confirmed we may then undertake a resection, obtaining the man's permission beforehand to amputate if we find it necessary. (This man has obstinately and persistently declined to have even an exploratory incision made and therefore we will be compelled to use radium needles.)

In this arena I speak of sarcoma of bone with a rather particular interest, because my old Master the late Professor Samuel W. Gross, was immensely interested in it, and in 1879 wrote a classical article upon the subject in the American Journal of the Medical Sciences.

There have been written three most notable articles on the subject in the last sixty years. That of Velton in 1860 that of Gross in 1879 and that of Bloodgood of Johns Hopkins, in 1919. A most striking article upon the subject the best of pathologic articles in any text-book is that of James Lwing of New York City in his book upon Neoplastic Diseases.

(Examination made later by Dr Manges showed the lungs strewn with sarcomatous nodules)

PRESBYTERIAL SPONTANEOUS GANGRENE

We present a man born in Galicia thirty two years of age a storekeeper by occupation. About a year ago this man began to suffer from severe pain in the right foot and calf of the leg when very tired or exposed to cold. Soon after he began to exhibit like phenomena in the left foot. The attacks became more and more frequent and more violent. Every now and then on rising from a chair getting out of bed or walking he would have such very violent pain that he was forced to sit down immediately even if he were in the street. This condition was intermittent claudication. He then noticed that when he hung his feet over the edge of the bed that the toes and dorsum of each foot grew purplish red and looked swollen a condition the neurologist calls erythromelalgia. A few days ago black spots appeared on the great toe two of the other toes and the dorsum of the right foot. He is now completely crippled by pain and has come to us for advice. As I move the extremities you see the spots of dry gangrene. As I ask him to sit on the edge of the bed and hang his legs down you see the purplish-red engorgement of the toes and feet and that he complains of violent pain. As we raise the extremities to the horizontal the color quickly disappears leaving a mottled whitish appearance. There is no pulse in the dorsalis pedis or the posterior tibial arteries of either extremity in fact I cannot feel a pulse in either extremity until the examining fingers reach the popliteal so it is evident that those large arteries are blocked.

What disease are we dealing with. It is that disease which Professor Buerger of New York has done so much to illuminate which he called presbyterial spontaneous gangrene and which he calls thrombo-angitis obliterans in the large arteries and in the deep veins of the leg. Inflammation arises. Clots form. The clots become canalized and vascularized. Connective tissue forms and is largely devoid of elastic fibers. The condition

probably begins in the artery with occluding thrombosis. Evidently fibrous tissues forms in large quantities. The artery vein, and nerves adhere and violent pain is the consequence. In cases of long duration arteriosclerosis will be found. In all probability the inflammation is due to some unknown infection. In this disease if the clot forms slowly and the collaterals develop distinctly gangrene will not occur. If the clot forms rapidly and the collaterals are in poor condition gangrene will occur. Mayesima points out that in this form of gangrene there is increase in the viscosity of the blood. Just as oil will run through narrow tubes less easily than water so viscous blood will run through narrow vessels less easily than thinner blood. Blocking will occur more easily when there is increased viscosity of blood than when there is not.

This disease occurs particularly between the ages of twenty and forty. I have never seen a case in a man over fifty. It is said not to occur at all in women. Some think female immunity is due to the internal secretion of the ovary which protects the female sex. I have seen one woman apparently suffering from thrombo-angiitis which had not gone on to gangrene. It is not limited to Jews, but an enormous majority of the patients are Russian, Galician, and Polish Jews in our large cities. An exactly similar form of gangrene is known to arise after typhus fever. Some have tried to attribute to indoor work the blame for the disease. Some have laid it to excessive use of the legs, some to unlimited cigarette smoking, and some to a diet of salt meat, but none of these alleged causes can be proved.

It usually but by no means invariably begins in the left leg. In the case before you it began in the right leg. It may begin nearly at the same time in both legs. If it begins in one leg the other is almost certain to become affected sooner or later. It comes on with attacks of violent pain in the toes, foot, or leg. Early in the case the extremity lacks pulse and whereas when the person is free from pain the pulse may be felt it cannot be felt during the pain. After a little while the pulse disappears altogether. The attacks at first are caused by cold or effort, later they arise spontaneously. The claudication and the ery

thrombalgia are typical. These patients become exhausted from the violent pain. In most cases sooner or later gangrene occurs. It may occur in a few months but it usually doesn't occur for a year or more. In one of my cases I amputated the leg above the knee. At a later period the other leg above the knee and later still reamputated the extremity which was first operated upon. A few weeks later the man died probably from involvement of the renal vessels and at that time there was beginning gangrene of the hands.

All sorts of things have been tried in treatment. Two things are necessary. First, to lessen the viscosity of the blood, and second to enlarge the collaterals. Ringer's solution given by hypodermoclysis frequently causes great abatement of the pain, sometimes seems to lessen the tendency to gangrene, and to lead to a line of demarcation. It is injected daily or every other day for fifteen or twenty times, and then, after a wait, another series of injections is given.

Doctor Steele, of Philadelphia, and others have had greater success by the intravenous injections of a 2 per cent. solution of citrate of sodium 250 c.c. at a dose. During the first month the injection is given every other day during the second month every third or fourth day.

Persistent heating of the extremity with electric bulbs at a temperature of 110° F. is the best means for enlargement of the collaterals. During the first month the patient is kept in bed and the heat applied continuously. This plan of treatment if carefully handled may prevent gangrene or may lead to the arrest of gangrene which has once started.

If a definite line of demarcation forms we can gradually separate the dead parts. If no definite line of demarcation forms, the one possible treatment is amputation above the knee. You may well ask me why not remove the blocking clot. The answer to that question was given by Bernheim a few years ago. He said it is not possible to remove the clot surgically because the material constituting the block is organized and adheres to the wall of the vessel, and furthermore the veins contain clot. Again you may ask me why not perform the operation of re

venal of the circulation. The answer to that is evident. The
veins also contain clot and hence we cannot deviate blood from
a blocked artery into an unblocked vein but only from a blocked
artery into a blocked vein. This would be stupid and perhaps
harmful.

This is an extremely interesting disease increasing in frequency and in which the discovery of the cause might lead us to the cure.

I trust that some of you in the future will give special time to its investigation.

CLINIC OF DR JOHN G. CLARK

UNIVERSITY HOSPITAL

PROLAPSUS UTERI; ULTIMATE RESULTS IN 100 CASES

It is our purpose today to take up the consideration of the various phases of prolapsus uteri. A short time before the Great War began a distinguished German professor stated that as yet no fully satisfactory method had been developed for the treatment of prolapsus uteri. From my personal observation of clinical work in Germany and the United States I am convinced that American gynecologists have been very much ahead of the Germans in developing the best operative methods for the treatment of these anatomic defects. In order to ascertain the ultimate results in cases treated by the various procedures which we have pursued my associate Dr Charles C. Norris and I have made an intensive study of 100 cases. The careful collection of the clinical statistics and the analysis of the cases have been made by Dr Norris. Many points in surgical technique which we have found most effective have been suggested by our other associates, Dr Ansbach and Dr Keene. We feel therefore that the methods employed are more or less composite and represent the combined efforts of the staff of the Gynecologic Department of the University Hospital.

We are under the greatest obligations to Dr William P. Blood, of Harvard for the loan of his excellent drawings depicting these plastic operations, which appear in his Text-book on Gynecology. Only those phases of our work which have been found most useful some of which are original, others modifications of standard methods have been illustrated. Other methods the descriptions of which have hitherto appeared in gynecologic text books have been employed as seemed indicated but have not been described for the obvious reason that

they are accessible for study in their original sources of publication.

Within the last few years many different operations for the cure of *prolapsus uteri* have been suggested, and the ultimate results have varied considerably in the reports of several writers. Because the results of our efforts of eight or ten years ago were not so satisfactory as we desired we revised our operative technique, modifying from time to time some points and adding others, hoping thus to overcome the errors observed in our earlier series of cases. This evolution in the treatment of these cases has been followed by a decided improvement which we attribute to these changes in viewpoint. Formerly our efforts were directed toward correcting a lacerated perineum, a relaxed pelvic floor or a uterus in varying degrees of descensus now we treat these cases as varying degrees of *hernia*.

All forms of prolapse of the uterus, vagina, bladder and rectum are but varying stages or phases of a *hernial* problem. There is no operation that will invariably be adapted to all these cases, and there is no policy therefore, that so jeopardizes *uniform success* as an adherence to a one-pattern plan of operation. So long as the operations of Emmet, Hegar and Taft were accepted as fixed and unvarying standards, there was a wide range between an ideal functional restoration and a relatively large proportion of disappointing results.

In our earlier surgical treatment of prolapsus cases we advocated the Emmet principle in perineal operations in conjunction with an oval anterior colporrhaphy which was followed in turn by suspension operation—usually the method of Kelly in younger women, and fixation of the uterus to the anterior abdominal wall in older women. This plan of treatment yielded satisfactory results in many cases, but the percentage of recurrences was sufficiently large to render a complete revision of our methods of operation necessary in order to assure a larger and better surgical output. This phase of our work is now regarded by us as valuable transitory experience that has carried us forward into a much more secure surgical field in which the final results are more uniformly satisfactory.

The Emmet perineal operation has been abandoned and we have substituted a modification of the Hegar operation.

For our inventory of ultimate results we have chosen 100 consecutive cases which have been checked up either by personal interview and examination or by letters to patients and their home physicians. No case has been included in which less than a year has elapsed since the operation.

Before considering our present plan of treatment we must say a word as to our evolution from former to present standards of procedure. For several years we not only practised the Emmet perineal operation, but taught that this was the last word in plastic surgery as applied to the posterior vaginal wall. When, however we carefully reviewed our more remote post operative results, we discovered that in this we were in error for although this operation proved successful in a large percentage of cases of simple rectocele, in those of more extensive type and in prolapse of the uterus the method was ill adapted to meet the conditions that caused the prolapse. Its greatest defect lies in the fact that the crest of the rectocele and the hernia in the higher reaches of the vagina are not corrected. Similarly any type of suspension operation that attaches the uterus to the anterior abdominal wall is also based upon a fallacious principle.

A prolapsus is a hernia of the uterus in which Douglas culdesac is a chief propagating factor. Merely therefore, to repair the external exit of this hernia—the vaginal outlet—by a plastic operation and to suspend the offending organ leaves the chief intermediary part of the hernial tract, Douglas pouch and the upper portion of the vagina, still untouched. Under this plan, therefore, recurrences will be too frequent.

To Moscovitz and Frank of New York, we are especially indebted for calling our attention to the tremendous hernial possibilities of Douglas culdesac. Indeed we are in full accord with Moscovitz's belief that this pocket is a potent cause in the propagation of a prolapse of the rectum and it is the ultimate factor in the production of a complete procidentia uteri after the initial descensus of the uterus occurs. With the uterus

descending in midposition or retroflexion the intra-abdominal impact is directed into Douglas' culdesac, after which the hernial sac is thrust downward driving a wedge between the rectum and the vagina. Complete prolapse is then a matter of a relatively short time. It becomes quite obvious therefore that to restore these cases successfully to normal health, the hernia interposed between the rectum and the upper part of the vagina must be obliterated.

For analytic purposes the cases of genital prolapse may be grouped as follows:

A. Pseudoprolapsus uteri. In which there is a hypertrophically elongated cervix projecting from the vaginal outlet, with or without an accompanying cystocele or rectocele the body of the uterus nevertheless occupying essentially its normal position in the pelvis. In these cases the anatomic variations are much less extensive than in a partial or complete prolapsus and the surgical principles of treatment are, therefore correspondingly simpler and the final results uniformly satisfactory.

B. Partial prolapsus uteri. In which the cervix appears at the vaginal outlet and is associated with cystocele and rectocele alone or in combination. In this class we are usually dealing with three herniæ involving the rectum, the bladder and Douglas' culdesac, the uterus appearing as a projecting mass.

C. Complete prolapsus uteri. In which the uterus is enclosed in a hernial sac, Douglas' culdesac, completely outside of the vaginal outlet associated with more or less extensive cystocele and rectocele (external and rectal herniæ).

In Group A pseudoprolapsus uteri, it is obvious that amputation of the cervix and efficient repair of the cystocele and rectocele will effect perfect result. In Group B partial prolapsus, the same procedure may effect cure. It is especially in this class of cases—in women who have passed the childbearing period—that we perform a type of Wertheim's operation before undertaking the perineal operation. In younger women after completing the perineal operation in the effort of entering the uterus beneath the bladder we usually open the abdomen and shorten

the round ligaments according to the Coffey plan. In our earlier cases we considered this procedure sufficient to accomplish the purpose but in an occasional instance the functional result was not satisfactory because we neglected to shorten the uterosacral ligaments—in other words we failed to overcome this hernial tendency in Douglas culdesac. With our revised methods in all those cases in which there is a decided descensus of the uterus we shorten the uterosacral ligaments by plication on the posterior surface of the uterus at the cervicofundal junction according to Bovee's plan thus restoring the restraining function of this set of ligaments. In rarer cases, if Douglas pouch tends to form a considerable hernial pocket, this also is obliterated by plication with catgut sutures, as suggested by Moscovitz after which the round ligaments are shortened according to the Coffey plan.

In a few cases we have performed the Baldy Webster operation but, because of its frequent failure to give symptomatic relief we have long since abandoned the method, for while the uterus may be restored to a normal position the patient often complains of a dragging sensation in the pelvis. We attribute the failure to obtain relief to the fact that either through direct tension or through possible adhesions or cicatrices forming at the site where the ligament perforates the broad ligament direct pressure is made upon the utero-ovarian circulation thus giving rise to congestive disturbance. In an analogous manner a boy on crutches may be suspended clear of the ground but his arms will suffer as a result of pressure on the axillary vessels. The Coffey plan of shortening the round ligaments, on the other hand has been uniformly satisfactory.

In the C group in women beyond middle life we usually perform first a vaginal hysterectomy and then, following the Charles Mayo plan, pull the broad ligaments well down into tension and after they are stitched together anchor them in the vaginal vault in such a way that, when released they spring back into the pelvis pulling up the vaginal fornix, thus holding it in secure suspension. Before doing this, however frequently we take advantage of the opening in Douglas pouch to obliterate

the deeper part of this space by plaiting it together with running catgut sutures. This procedure effectively blocks a large hernial impulse which otherwise predisposes to a postoperative prolapsus of the vaginal fornix and an ultimate eversion of the vagina. Since adopting this method of procedure we have seldom found it necessary to perform a celiotomy in these cases. In 3 cases in 100 in which Douglas culdesac was very greatly pouched and situated well outside of the vaginal orifice we followed the plan of Moscovitz: the patient was placed in an exaggerated Trendelenburg posture and the uterus drawn high up into the celiotomy incision, thus making it possible by placing successive layers of catgut stitches to obliterate Douglas culdesac, after which a partial hysterectomy was performed and the round ligaments were then implanted in the cervical stump. In some cases a panhysterectomy was necessary in which case the round ligaments were implanted in the vaginal closure. In obliterating Douglas pouch Moscovitz has warned against the dangers of including the ureters in the stitches for this reason they should be located by touch or sight and carefully shielded from hazard during the peritoneal plication. Fortunately the necessity for this rather extensive and slightly more hazardous operation is seldom necessary as the foregoing plans are adapted to at least 95 per cent. of even the exaggerated cases.

In the surgical treatment of a simple rectocele or cystocele no operation which does not go deeper than the skin coverings of these sacs will succeed. For this reason a simple oval denudation and suture in any type of cystocele will almost invariably fail. In a cystocele we deal with three factors: first the bladder as the hernial sac; second, the subvesical or pubocervical fascial webbing; and finally the vaginal musculature and skin. While the bladder can neither be excised nor deeply plicated, the sagging or broken interposed fascia between it and the vaginal wall may be restored by a carefully applied suture. Likewise the broken interposing fascia between the rectum and vagina can be brought back to its barrier like integrity. The simple perineal part of these operations is merely the concluding

step of a hernial operation in which the external outlet, like that of the external ring of an inguinal hernia, is restored to normal. In the posterior operation, the modification of the Hegar type, as evolved in our clinic, effectually carries the repair if necessary quite up to the cervix, permitting the operator to reach the interposing culdesac and suture it in such a way as effectively to preclude its further participation in the vaginal hernia, or rectocele. In two steps of the operation we are under obligation to our associates Dr B M Anspach and Dr F E. Keene, for their suggestions. To the former for the use of a subcutaneous stitch in the final steps of the perineal operation to the latter for suggesting that all of the stitches be inserted from the vaginal surface, thus doing away with the usual crown stitches which appear on the perineal surface. These additions to our technic have added to the success of the operation and greatly to the comfort of the patient. The gradual approach to well-established principles in plastic operations in our clinic is, therefore the cumulative result of associated endeavor. There is little of originality in this work, for as noted above, in many clinics we find the same principle in vogue with merely variations in operative technic. Our illustrations will depict the operative steps, and we shall not therefore enter into a detailed description of technic. In the study and analysis of the after-results in these cases I am indebted to my associate, Dr Charles Norris who has been indefatigable in his search for the good as well as the bad points in our work.

ANALYSIS OF SYMPTOMS

While the work of the gynecologists has pointed the way to the surgery of the upper abdomen this in turn, in its achievements has demonstrated the errors of so-called gastric reflexes emanating from pelvic sources. Acute or chronic symptoms in the upper abdomen are rarely if ever of reflex origin. If we required any convincing proof of this statement, a review of symptomatology in our 84 cases would furnish convincing evidence against this fallacy. In this entire number there were only 6 patients who complained of indigestion, and of this

number 3 had gall-stones removed during the course of the operation for prolapsus. The chief symptoms were directly attributable to the pelvic disability. The one paramount fact which is most patent is that gastric disturbances and general nervousness are the least frequent of all of the patient's complaints. In the order of frequency the symptomatology is recorded as follows in 84 cases:

Presence of menses	70
Pain in lower abdomen	28
Leukorrhoea	27
Backache	21
Frequency of urination or incontinence	27
Dysuria	22
Pain on urination	18
Headache	6
Menorrhagia or metrorrhagia	15
General leucorrhoea	7
Pain on defecation	1
Varices	2
Indigestion	6
Verrucae	5
Dysmenorrhoea	2

In conjunction with the prolapsus uteri the following associated pathologic conditions were noted which unquestionably participated to a greater or less extent in this symptom-complex:

Cholelithiasis	3
Appendicitis or peri-appendicitis	5
Myoma uteri	6
Hemorrhoids	7
Complete test	4
Prolapse of rectum	2
Hernia	5
Pelvic inflammatory disease	1
Vesical calculus	1

A preconceived opinion as to recurrences has not been sustained by our review of cases. We believed when we started this review that our percentage of recurrences or imperfect results would fall within the years after the menopause first and naturally because the majority of cases falls within those

years. In our series of cases 66 per cent. were forty-five years of age or over the decade between fifty five and sixty-five years of age furnished 37 per cent. Due to this fact we expected to find our unfavorable results falling within these later years, but such is not the case as our few failures bear no relationship to the age of the patient. One very evident clinical fault is all too obvious that is, these patients usually have gone entirely too long without surgical help. Only 7 cases have come to operation within one year after the appearance of the prolapsus. In 37 other cases the interval between the appearance of the prolapsus and the operation has been between four and twenty five years. In a few cases they had not previously consulted a physician but the great majority had either been advised by the family doctor to let matters alone or had been tided over with some form of pessary. Too often that ugly fallacy encompassed within the statement, "Wait for your menopause, and you will get well," is dealt out to these patients. While the results of these operations contrary to our preconception, have turned out as well after as before the menopause certainly with the progressive increase in the size of the prolapsus the extent of the operation is much greater and, to say the least, postoperative morbidity is proportionately higher.

For the correction of associated pathologic conditions the following operations have been performed appendectomy 17 cholecystectomy, 3 hemorrhoidectomy 8 herniorrhaphy 5 salpingectomy 10 removal of cervical polyp, 1 myomectomy, 2 Webster's operation for diastasis recti, 2. In this entire series there has been no death.

TYPE OF OPERATIONS

Because of the many factors entering into the etiology of these hernia it is obvious that no one type of operation is applicable to all cases. Many anatomic variations render necessary a special surgical adaptation of measures to each case. Upon a careful individual study of each patient success depends. In the series of cases utilized for this study the following operation were employed

Clark's modification of Hegar's operation, 79 Emmet's operation 3 anterior colporrhaphy 65 dilatation and curetage, 50 trachelectomy 50 trachelorrhaphy 8 Coffey suspension of the uterus, 12 ventral suspension of the uterus, 3 Baldy-Webster suspension of the uterus, 3 ventral fixation of the uterus, 7 Watkins' Interposition, 30 vaginal hysterectomy 15 supravaginal hysterectomy 8 operation for complete laceration, 5 partial vaginal hysterectomy 2 plication of uterosacral ligaments and peritoneum of Douglas culdesac combined with some other suspension operation, 3 excision of prolapsed vaginal stump 2 fixation of cervical stump to lower angle of abdominal wound 2.

An analysis of the above list shows that either the fundus or the entire uterus was removed in 21 cases vaginal hysterectomies, 14 supravaginal hysterectomies, 17. Some variety of intra-abdominal suspension of the uterus was performed in 23 cases Coffey suspension in 11 ventral suspension 3 ventral fixation 6 Baldy-Webster suspension 3.

Thus the uterus was either removed or suspended in 44 cases and Watkins operation was performed twenty-eight times. In other words, the uterus was either removed or suspended in every case except those in which the Watkins operation was utilized. The larger number of hysterectomies have been performed during the latter period of our series since we have adopted the plan of utilizing the ligamentary attachments of the uterus for the support of the vaginal fornix. Perineorrhaphies were performed on all cases, all but 3 being Clark's modification of the Hegar operation. Anterior colporrhaphies were performed fifty five times as a matter of fact, anterior wall operations were probably performed somewhat more frequently than this, but were not noted on the operation blank. This operation is performed routinely in all Watkins operations. In each case the analysis has been made according to the operation stated in the histories.

In nearly all supra vaginal hysterectomies the stump has been suspended by fixing the round ligaments into the cupped out cervical stump. In some cases, in addition to this, either

the ends of the infundibulopelvic ligaments, or in cases in which the adnexa were conserved, the proximal tubal ends and part of the broad ligament have been included in the cervical stump. In only 2 cases the cervical stump (after an abdominal hysterectomy) has been fixed to the abdominal wall. This statement is confirmatory of our theory that this procedure is to be avoided except in very rare instances.

The results of our questionnaire and examination of cases of this series show that, while the anatomic results were on the whole, good, the symptomatic results were even better. In none of our series of cases has there been any mortality and the morbidity has been slight. It has been our experience that practically all cases in which plastic operations are performed on the anterior vaginal wall require catheterization in some this condition lasts for one day only while others are unable to void for two three, or even more days. When catheterization has to be resorted to for more than twenty-four hours the routine administration of urotropin has usually been resorted to as a prophylactic measure against cystitis. When possible it is advisable to have these patients practice urination while in the recumbent posture for a week or two prior to operation. In all cases we employ catgut sutures. In 2 or 3 cases there has been postoperative bleeding, probably due to premature absorption of the suture material, which has been controlled easily by a vaginal tampon. We also have had a few cases of infection. This is especially likely to occur in extensive anterior wall operations unless particular attention is paid to hemostasis.

Notwithstanding an occasional focal infection, in no case has it been sufficient to necessitate a secondary operation, and its influence upon our final results has been almost negative. For a short time we used a continuous buried suture, but this has the disadvantage, if an infection occurs, of a more extensive impairment of the wound than when the interrupted sutures are employed. In the first instance the suppuration is confined to the deeper tissue in the latter it more quickly finds an exit.

SUMMARY OF ANSWERS TO THE FOLLOWING QUESTIONNAIRE

1 Have you been benefited by your operation

Cured 70 greatly improved, 7 improved, 5 not improved, 2 worse 0 One patient has been completely cured of prolapsus but has had a very serious nervous collapse which has made her an invalid Three patients answered "improved" but from the remainder of the answers in the questionnaire they are apparently cured.

2 Have you had any frequency or pain on passing water? Yes slight, 6 no 68

(a) If so how often do you have to pass water during the day? Six patients, eight to twelve times.

(b) If so how often during the night Nine patients, two to five times.

(c) How soon did it appear after operation. Immediately 8 one year after 2 soon after 10

(d) When did it disappear? Still present in 9 cases. Present for one year 1

3 Have you been able to control the bladder since operation? Yes, 8 no 4

(a) If not when did this symptom appear? Immediately 3

(b) When did it disappear In three or four months, 1 still present, 2

4 Has there been any falling of the womb since operation Yes, slight, 8 no 6.

(a) If so is it as large as before operation Yes, 1 no 7

5 Has there been any undue (abnormal) bleeding from the vagina since operation Yes 0 no 82

6 Have you had any pain or discomfort in the operative region? Yes, 3 no 74

(a) If so how soon after operation did it appear Immediately 3 Only 3 patients answered this question.

(b) Is it now better worse or has it disappeared? Better 3

(c) Describe the pain. Soreness in lower abdomen 2. Pain in vagina 1 Only 2 patients answered this question

Is your general health better than before operation Yes

(a) How was your health before operation Good 8 fair 22 poor 47

No patient has had a second operation since leaving the University Hospital

One patient operated upon five years ago was according to her husband's statement, cured but died two years ago from goiter. Another patient was reported by her physician as cured but died two years after her operation from hyperthyroidism and auricular fibrillation. One patient was pregnant at the time of the receipt of the questionnaire. Another one has had 2 children since operation she reported that she was cured and there had been no recurrence. Of the 100 cases selected for study we failed to trace 14

CONCLUSIONS

1 Cases of prolapsus uteri should be treated upon a hernial basis in which Douglas pouch, the rectum and the bladder participate as protruding sacs into a weakened vaginal canal the vault of which becomes a primary point of weakness. It is easily explainable therefore, that a simple perineal operation with an associated suspension of the uterus or with a hysterectomy will frequently fail because the essential weakness in the upper part of the vaginal canal both anteriorly and posteriorly is overlooked and the correction of the primary hernia in Douglas culdesac is not, therefore effected

2 To overcome the surgical defects of previous years the broken or weakened fascial layer and muscles making up the septum between the vagina and the rectum are now corrected by extending the usual perineal operation high up into the vagina even to the cervix.

3 Suspension or fixation operations as applied to the uterus will frequently fail because the hernial pocketing in Douglas culdesac is not corrected as a result of which the continuous drag in this area leaves the patient still uncomfortable or may lead to recurrence of the prolapsus.

4 In complete prolapsus of older women a vaginal hysterectomy with attachment of the broad ligaments to the upper

vaginal extremity or a supravaginal hysterectomy with these ligaments applied as inserts *into the cervical stump*, with plication of the dependent Douglas pouch, is most efficient.

5. In younger women, within the childbearing period of life the utilization of the uterosacral ligaments plicated upon the posterior wall of the uterus at the cervicofundal junction, followed by some form of shortening of the round ligaments, with us preferably the Coffey plan, is almost invariably successful.

6. The interposition operation (Watkins) is the method of choice in women beyond the menopause when the cervix descends only to the vaginal outlet. Of late we find the interposition operation of less necessity if there is performed a trachelectomy followed by a careful anterior colporrhaphy. The effectiveness of the latter procedure depends upon the restoration of the weakened area between the lower third of the uterus and the vesical wall. Here the hernial tendency is very pronounced, and, if this area is not blocked, a recurrence is probable. In the correction of the cystocele especial care must be observed in dissecting free the subvesical fascia and utilizing it as a suspensory sling for the support of the bladder. In all of this work the chief factor lies in the restoration of weakened or disrupted fascial supports.

ILLUSTRATED STEPS OF PLASTIC OPERATIONS APPLIED TO ANTERIOR AND POSTERIOR VAGINAL WALL

The following drawings illustrate the important steps of plastic operations for cystocele and hernia of the posterior vaginal wall as performed in the Gynecologic Clinic of the University Hospital. Special stress is laid upon the importance of restoring the fascial supports of the vagina and the uterus as a primary requisite for success in any method of treating prolapsed uteri. No attempt has been made to depict the various established methods of treating the prolapsed uterus which we have employed in our series of cases as they have been repeatedly illustrated in various medical periodicals and text books. To these sources the reader may turn for information as to their methods of execution.

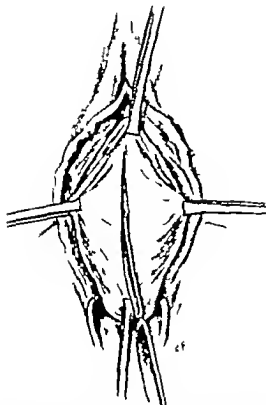


Fig. 18.—The cystocele is pulled all down to the vaginal outlet with tenaculum applied to the cervix. In incising the anterior vaginal all care should be observed not to cut through the underlying fascia. With sharp knife or scissors the fascia is dissected away from its alba attachment, or it may be pushed upward with the finger enveloped in gauze sponge.



vaginal extremity or a supravaginal hysterectomy with these ligaments applied as inserts into the cervical stump with plication of the dependent Douglas pouch, is most efficient.

5 In younger women, within the childbearing period of life, the utilization of the uterosacral ligaments plicated upon the posterior wall of the uterus at the cervicofundal junction, followed by some form of shortening of the round ligaments, with us preferably the Coffey plan, is almost invariably successful.

6 The interposition operation (Watkins) is the method of choice in women beyond the menopause when the cervix descends only to the vaginal outlet. Of late we find the interposition operation of less necessity if there is performed a trachelectomy followed by a careful anterior colpomythaphy. The effectiveness of the latter procedure depends upon the restoration of the weakened area between the lower third of the uterus and the vesical wall. Here the hernial tendency is very pronounced, and, if this area is not blocked, a recurrence is probable. In the correction of the cystocele especial care must be observed in dissecting free the subvesical fascia and utilizing it as a suspensory sling for the support of the bladder. In all of this work the chief factor lies in the restoration of weakened or disrupted fascial supports.

ILLUSTRATED STEPS OF PLASTIC OPERATIONS APPLIED TO ANTERIOR AND POSTERIOR VAGINAL WALL

The following drawings illustrate the important steps of plastic operations for cystocele and hernia of the posterior vaginal wall as performed in the Gynecologic Clinic of the University Hospital. Special stress is laid upon the importance of restoring the fascial supports of the vagina and the uterus as a primary requisite for success in any method of treating prolapsus uteri. No attempt has been made to depict the various established methods of treating the prolapsed uterus which we have employed in our series of cases as they have been repeatedly illustrated in various medical periodicals and text books. To these sources the reader may turn for information as to their methods of execution.

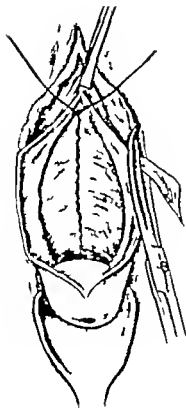


Fig. 20.—The fascial suture is completed. The white area on the anterior face of the cervix represents the point at which the vesical fascia has been detached and shoved up on the face of the uterus.

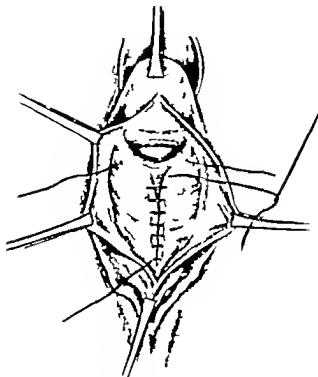


Fig. 19.—The fascia has been freed from skin attachment. The pillars of this fascial layer, which swing around the cervix, have been detached, and the bladder as lateral sac has been pushed up underneath the fascia. A continuous catgut suture (No. 1) has been carried down the pillars, but at this point No. 2 chromicized catgut is caught in the lateral borders of the fascial pillars, carried down into the anterior cervical wall, and finally tied, thus effectively placing barrier against the vaginal canal. The No. 1 continuous suture is then carried up to its point of insertion, thus further infolding the sagging fascia.



Fig. 22.—The anterior vaginal wall as it appears with the colporrhaphy completed.

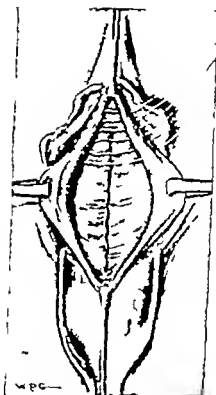


Fig 21.—T plan has been followed in closing the skin covering the cystocele after mattress sutures, such as illustrated here or simple interrupted sutures of No. 2 chromicized catgut are applied. After the completion of this step, row of five catgut plication sutures are employed bring the skin surface into normal position (Graves.)

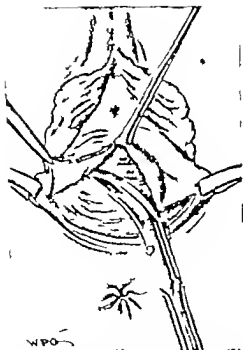


Fig. 24.—The abdominal dissection is completed, the fascial plane between the rectum and the uterus being exposed. Precaution is observed not to cut through this plane otherwise the perirectal fat will be exposed and unnecessary bleeding may occur. (Graaf.)

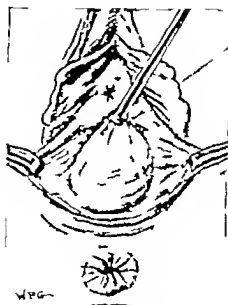


Fig. 23—T points are essential in defining the area of skin denudation, first the incision is carried from the perineal body to the base of the rectocele hence upward as superimposed inverted A beyond the point of bulging the vagina. By the first maneuver and so narrowing of the vagina all be rooded, and by the second the higher reaches of the vagina, from which the hernia begins, will be laid bare. (Grafer.)

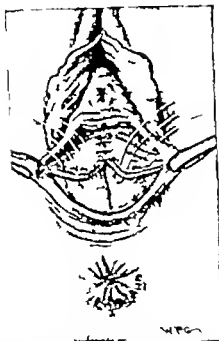


Fig. 26—Interrupted sutures applied to bring into close apposition the skin covering the fascia. The purpose of the triangular flap in the vagina is here illustrated. Through this step cicatrization and ultimate narrowing of the vagina with the possibility of dyspareunia is avoided. (Grauer.)

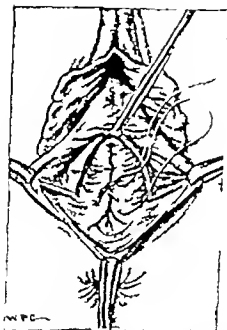


Fig. 23.—Either No. 2 continuous chromicized catgut suture is applied from the top of the exposed fascia down to the vaginal outlet, or, as usually executed, deep interrupted catgut sutures are inserted, thus bringing into apposition the lateral fascia and musculature. By this means a firm recto-vaginal septum is restored high up to the inguina, even to the cervix, in exaggerated cases of hernialization. (Graefes)

CLINIC OF DR. CHARLES H. FRAZIER

UNIVERSITY HOSPITAL

A CLINICAL LECTURE ON TRIGEMINAL NEURALGIA

BY way of introduction let me remind you of the origin and distribution of the trigeminal nerve. You recall its sensory root originates in a nucleus in the pons, passes forward toward the apex of the petrous bone where a small opening in the tentorium is provided from which it emerges in the middle fossa to enter the ganglion of Gasser. I want to remind you too that the motor root of which we will have something to say later lies just beneath the sensory root, but passes behind the ganglion to join its third or mandibular division. Now if you will look at this skull you will see the position occupied by the gasserian ganglion in the cavum Meckelii and it has several important relationships that are of practical significance. Note the position of the foramen spinosum through which passes the middle meningeal artery. In this skull it is to the outer side and

little posterior to the foramen ovale. This is not a constant relationship however as the foramen sometimes is as far forward as the foramen ovale so that as one approaches the foramen ovale in operations upon the ganglion or its sensory root the middle meningeal artery must be divided before the third division which makes its exit through the foramen ovale can be approached.

In close relation with the inner margin of the ganglion are the third, fourth and sixth cranial nerves and the cavernous sinus. The proximity of this structure was a matter of concern to the surgeon when excision of the ganglion was the conventional operation for the treatment of trigeminal neuralgia and not infrequently one or the other of these structures was injured in

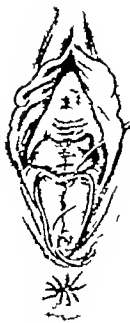


Fig. 27.—The subcutaneous catgut suture (No. 1) is inserted just thru the vaginal orifice and carried down over the face of the perineum, first bringing into snug position the superficial perineal fascia on reaching the lower angle of deviation it returns as true subcutaneous suture to the opposite side of its insertion. (Graeser)



Fig. 28.—The perineal fascia and subcutaneous stitch completed and ready to tie. (Graeser)

We have spoken of the sensory and motor function of the trigeminal nerve. We attribute also to it a *trophic function*. At least there are believed to be trophic centers in the ganglion that preside over the cornea. The trophic disturbances of the cornea, which sometimes follow operations upon the ganglion or even alcoholic injections of the ganglion have been attributed to disturbances of the trophic supply



Fig. 29—T areas of anesthesia: the larger immediately after the sensory root operation: the other five years later

Now there is but one indication for operation upon the trigeminal nerve—the relief of pain—but before we take up the question of treatment I want to discuss very briefly the various forms of trigeminal neuralgia, as their recognition has an important bearing upon the determination for or against surgical interference.

1 There is the neuralgia which, for a better term I may

the course of that operation. You will learn later that this operation has been abandoned and the proximity of these structures is now a matter of no practical concern. The gasserian ganglion is enclosed in a special envelope which we call the *dura propria*, which in the course of the operation must be divided before the ganglion or its sensory root is uncovered. I want you to note, too, the general position of the ganglion in the middle fossa, and you will see that the most direct approach to the ganglion is from the middle of the *xygoma* or a little posterior to that point.

You will remember that the function of the trigeminal nerve is predominantly sensory of its three main divisions, only the third or mandibular has any motor representation, supplying the temporal, masseter and pterygoid muscles. In this chart you see the territory supplied by the three divisions—the ophthalmic, maxillary and mandibular. The left trigeminal territory as a whole, is flanked on its mesial surface by the zone of the right trigeminal nerve and on its posterior and inferior surface by the zone of the cervical nerves. Only one of these boundaries, however is constant, namely the mesial, the inferior and posterior have considerable variation in different subjects. Not only is this the case but in the mesial aspect there is never any overlapping of function, while on the other two aspects there is. You will see from this photograph that the area of anesthesia on the mesial surface has not changed a millimeter it is exactly in the median line. In other words, there is never any overlapping of function between the right and left trigeminal nerves. Compare this line with the line on the inferior boundary. Here the line of demarcation has changed very materially. Immediately after the operation the anesthetic zone included part of the ear and followed the lower margin of the inferior maxilla. Five ears later this line is in advance of the ear and several centimeters above the lower margin of the inferior maxilla. One can only explain this shifting of the anesthesia on the assumption that there is some overlapping of function on the part of the cervical nerves. Just why this is not manifest immediately after the operation is difficult to account for.

and involved the several main divisions of the gasserian ganglion after their exit from the skull.

As you might expect when the seat of the lesion is peripheral to the ganglion, the pain is more or less constant, though intense, and lacks the shooting and paroxysmal character of the pain of *tic douloureux*. As these tumors are inoperable one refrains from advising the radical operation, and yet these



Fig. 30.—Case of tumor of cerebellopontile angle simulating trigeminal neuralgia. The patient had already had radical operation on the ganglion before his admission to our service.

patients make pitiable appeals for relief and I find myself in increasing numbers giving alcoholic injections either of the second or third division or if need be of the ganglion itself with intense satisfaction and with immeasurable gratitude on the part of the patient.

2 In 1907 J. Ramsay Hunt constructed a clinical picture in which the principal feature was an otalgia although the pain

call toxic. In the majority of cases which I have seen the pain is in the supra-orbital division. Sometimes on one sometimes on both sides. The pain may be intense, but it is constant, not paroxysmal, and of a boring character. The attack may last several days without *intermission*. This form of neuralgia is not relieved by surgical measures.

2. You are all familiar with the form of neuralgia associated with infection in the trigeminal distribution, as of the teeth and sinuses. In the majority of instances this pain subsides with the subsidence of the infection. In exceptional cases it may persist with such severity as to demand either an alcoholic injection or the division of one of the peripheral trunks. But in this connection I want to impress upon you the fact that in but the rarest exceptions is dental infection or infection of the accessory sinuses a precursor of the major form of neuralgic *douloureux*, for the relief of which the major operation is indicated.

And now I am going to refer to several forms of neuralgia in which the pain may be within the trigeminal field, but the origin is not primarily or wholly within the trigeminal system. I refer (1) to the neuralgias secondary to tumor invasion, (2) to neuralgia of the geniculate ganglion, and (3) to neuralgia of the sphenopalatine ganglion.

1. Time will not permit of a discussion in detail of the neuralgias that are directly the result of pressure or infiltration of tumors. In our clinical records you could find cases representing different groups classified according to the location of the tumor. You will see the record of a case in which there was a cerebellopontile tumor involving the sensory root of the ganglion. Before his admission to my clinic the patient had had numerous operations including a gaseclectomy, all without relief. You will see the record of an unusual case of endothelioma of the ganglion, in which the character of the pain closely simulated that of *tic douloureux*. There are other cases of middle fossa tumors not originating in the ganglion and these are more common. And finally you will see records of cases in which the tumors usually carcinomata have invaded the pterygoid fossa

and involved the several main divisions of the gasserian ganglion after their exit from the skull.

As you might expect when the seat of the lesion is peripheral to the ganglion, the pain is more or less constant, though intense, and lacks the shooting and paroxysmal character of the pain of tic douloureux. As these tumors are inoperable one refrains from advising the radical operation, and yet these

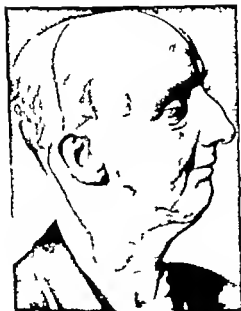


Fig. 30.—Case of tumor of cerebellopontile angle simulating trigeminal neuralgia. The patient had already had radical operation on the ganglion before his admission to our service.

patients make pitiable appeals for relief and I find myself in increasing numbers giving alcoholic injections either of the second or third division or if need be, of the ganglion itself with intense satisfaction and with immeasurable gratitude on the part of the patient.

2 In 1907 J. Ramsay Hunt constructed a clinical picture in which the principal feature was an otalgia, although the pain

call toxic. In the majority of cases which I have seen the pain is in the supra-orbital division. Sometimes on one, sometimes on both sides. The pain may be intense but it is constant, not paroxysmal, and of a boring character. The attack may last several days without intermission. This form of neuralgia is not relieved by surgical measures.

2. You are all familiar with the form of neuralgia associated with infection in the trigeminal distribution, as of the teeth and sinuses. In the majority of instances this pain subsides with the subsidence of the infection. In exceptional cases it may persist with such severity as to demand either an alcoholic injection or the avulsion of one of the peripheral trunks. But in this connection I want to impress upon you the fact that in but the rarest exceptions is dental infection or infection of the accessory sinuses a precursor of the major form of neuralgia, *tic douloureux* for the relief of which the major operation is indicated.

And now I am going to refer to several forms of neuralgia in which the pain may be within the trigeminal field, but the origin is not primarily or wholly within the trigeminal system. I refer (1) to the neuralgias secondary to tumor invasion, (2) to neuralgia of the geniculate ganglion, and (3) to neuralgia of the sphenopalatine ganglion.

1. Time will not permit of a discussion in detail of the neuralgias that are directly the result of pressure or infiltration of tumors. In our clinical records you could find cases representing different groups classified according to the location of the tumor. You will see the record of a case in which there was a cerebellopontile tumor involving the sensory root of the ganglion. Before his admission to my clinic the patient had had numerous operations, including a gasserectomy all without relief. You will see the record of an unusual case of endothelioma of the ganglion, in which the character of the pain closely simulated that of *tic douloureux*. There are other cases of middle fossa tumors not originating in the ganglion and these are more common. And finally you will see records of cases in which the tumors, usually carcinomata have invaded the pterygoid fossa

trigeminal neuralgia has so many characteristic features that mistakes in diagnosis should be exceptional. Although seen occasionally in subjects under forty and exceptionally under thirty it is a disease of middle life and of old people. Beginning primarily in the second or third division in 95 per cent. of cases both of these divisions are eventually involved and some times the first division as well. The disease is characterized by attacks and the attacks in turn are featured by paroxysms of greater or less frequency. The attacks may last several weeks or months and are interrupted by intervals in which there is absolute cessation of pain. As years go by the attacks become more frequent, until finally there may be no interruption. Remember that this is a progressive disease, which so far as I know is not spontaneously arrested. The pain of the paroxysms is variously described as shooting, tearing or burning, there is often the sensation of a red-hot iron thrust into the tissues. To say that the pain is intolerable expresses it mildly. There is probably no greater suffering in the category of human ailments. The pain is referred to the terminal distribution of the particular division involved usually to the nose, upper lip and teeth of the second division or the lower lip, teeth, and tongue of the third division. Associated with the pain phenomena are certain motor and vasomotor disturbances, spasm of the facial muscles, lacrimation, rhinorrhea, salivation, and flushing of the face. These are merely incidental.

Rich as has been our experience with major trigeminal neuralgia, our knowledge of its etiology is pitifully deficient. My knowledge of this phase of the subject can be expressed only in negations. The disease is not due to any peripheral infection such as dental sepsis or inflammation of the accessory sinuses. It does not seem to be due to a peripheral ascending neuritis or to a lesion of the ganglion itself. At least histologic examinations of specimens removed at operation have not exhibited any lesions that could account for the pain. To discuss further the etiology of this disease would lead us into the field of speculation and would not be profitable.

This patient upon whom we will operate today has had all

may overflow into the trigeminal territory and occasionally to the neck and shoulder. These attacks, which may be preceded by attacks of herpes, are attributed by Hunt to lesions of the geniculate ganglion, with its sensory supply from the sensory branch of the facial nerve. In upward of 500 cases of neuralgia that compose our clinical experience there has been but one that might be assigned to this group.

3 There happens to be in the hospital now a lady whom I have asked to come to my lecture today as she presents the picture of a neuralgia that has been in recent years described by Shuder and attributed to lesions of the sphenopalatine ganglion. We will call it Shuder's neuralgia. The patient's pain is referred to the root of the nose, to the eye socket, in and about the ear to the occiput, the shoulder and arm. You will note that she winces when I make pressure over a point 5 mm. behind the mastoid process. This is a characteristic feature. In other cases pain may be referred to the frontal region, the tonsil, and pharynx. To confirm the diagnosis I will apply a 5 per cent. solution of cocaine immediately beneath the posterior tip of the middle turbinate, a point in close proximity to the sphenopalatine ganglion. The patient says her pain is entirely relieved and she feels as though a string had been cut and the tension and pain in the eye have entirely disappeared. This is the crucial test in the differential diagnosis and suggests a treatment which has been found more or less effective, namely alcoholic injection in or about the ganglion. Because of the difficulty in accurately placing the injection it may have to be repeated several times.

We come now to the neuralgia in which we as surgeons are especially interested. I sometimes speak of it as surgical neuralgia because it represents the type in the treatment of which surgical interference is an essential feature. But it is referred to in literature as 'major neuralgia as epileptiform neuralgia, and as 'tic douloureux. The most appropriate nomenclature is, I think, major trigeminal neuralgia as the term differentiates it from the neuralgia of origin other than trigeminal and from the minor trigeminal neuralgia. This major

of treatment, the injection and the operation that the former offers immediate but only transitory relief about nine months that the latter assures him permanent relief. Many questions will be asked as to the details of the injection and the operation, and after some deliberation the patient decides in favor of one or other usually depending upon how long he has been a sufferer. For example, the patient I am going to operate upon today has been a sufferer for ten years. He has had an alcoholic injection in each of the last four years. After the first injection



Fig. 31.—Sketch showing position of incision relative to the ear and zygoma, together with head tacker used on the special operating chair.

he was delighted with the result, at once resumed his business, and encouraged himself to believe that the pain would not recur. A year and a half later while at his desk he was seized with one of his old paroxysms. He endured it for a while, but after two weeks of it he turned up and asked for a second injection. The result of this, like the first, was gratifying to the patient. He ate his first square meal in two weeks and went back to business, again hoping he had seen the last of his pain. All went well for thirteen months when he had a second recurrence, coming on, as the first, out of a perfectly clear sky with no apparent reason.

his upper teeth extracted, but to no effect. This is a common experience. In fact, most of our patients have had the teeth either of the upper or lower jaw extracted and most of the teeth are sound, but because the pain is referred to the teeth the patient or often the dentist thinks the teeth must be the source of pain. This patient has gone through the usual gamut, including teeth extraction, investigation of all the slaves, osteopathic treatment, electric treatment, and endless drugs. His physician advised him to spend the winter in Florida in the vain hope that a warmer climate would spirit away the pain.

Only a few months ago I operated upon a Scotchman who had been sent from his home in Ayrshire, Scotland to Southern California on a similar mission, but, as you will learn, without advantage to the patient. I speak of this patient's experience in detail in the first place because it is such a common one, and second, because it will serve to impress upon you at least what not to do in the interest of your patient and incidentally his pocket book, and the corollary of this statement is this that there are but two justifiable methods of treating trigeminal neuralgia alcoholic injection and section of the sensory root of the gasserian ganglion. If you should forget anything else in the lecture about this disease I hope in the interests of human suffering you will remember this statement. It seems almost incomprehensible and yet it is too often the case that these subjects are allowed to suffer for years, two three six until perchance they find a physician or often as it happens, a former patient, who tells them what they should have done.

While this patient is being anesthetized in preparation for the radical operation I will send for another for whom I have planned an alcoholic injection. The question naturally rises in your mind why should the treatment in one case be alcoholic injection and in the latter the radical operation. The question is a very proper one and I can answer it best by telling you how the decision is made. It is made usually by the patient himself. It has been my practice when consulted by a patient with major trigeminal neuralgia, to tell him there are but two methods

of treatment, the injection and the operation that the former offers immediate but only transitory relief, about nine months that the latter assures him permanent relief. Many questions will be asked as to the details of the injection and the operation, and after some deliberation the patient decides in favor of one or other usually depending upon how long he has been a sufferer. For example, the patient I am going to operate upon today has been a sufferer for ten years. He has had an alcoholic injection in each of the last four years. After the first injection



Fig. 31.—Sketch showing position of incision relative to the ear and zygoma, together with head attachment used on the special operating chair.

he was delighted with the result, at once resumed his business, and encouraged himself to believe that the pain would not recur. A year and a half later while at his desk, he was seized with one of his old paroxysms. He endured it for a while but after two weeks of it he turned up and asked for a second injection. The result of this like the first, was gratifying to the patient. He ate his first square meal in two weeks and went back to business, again hoping he had seen the last of his pain. All went well for thirteen months when he had a second recurrence, coming on, as the first, out of a perfectly clear sky with no apparent reason

but the pain was more violent. A few days of it, and he rushed back to us for another injection, more or less demoralized and dejected. He dreaded the injections, and now he began to dread a recurrence. Though given absolute relief by the third injection, he was more or less apprehensive and uneasy and now realized that the injections would not cure him. Returning to business, he wondered how long it would be before he would be seized with another attack. It was only nine months the interval of relief was shorter after each injection his morale was broken and he returned to us pleading for some permanent measure of relief and as there is no contraindication, I have had him prepared for the major operation.

Now the experience of the second case is quite different, and it serves our purpose well for contrast. This patient has been a sufferer off and on for only eight months. The attacks, while severe have not reached their maximum severity. He couldn't quite make up his mind to have a major operation and as is my practice I have allowed him to make his own choice and he has chosen the alcohol injection. As the other patient is ready for operation I will conclude what I have to say about the injection until the operation is finished.

We are using ether as an anesthetic, skillfully given by a trained nurse anesthetizer who knows every step of the operation and keeps the patient under such light anesthesia that a few minutes after the sensory root has been cut the patient will be conscious to answer questions. Note also the patient is in the sitting posture a posture we have adopted for these reasons because there is less bleeding, because the patient requires less ether and because it is the most convenient posture for the operator as the field of operation is exactly on a level with his eyes.

Follow now the various steps of the operation the winged incision, the cutaneous flap reflected forward the musculo-aponeurotic backward. An opening in the skull is made 3 cm. in diameter the center of the opening opposite the mid point of the zygoma and the lower margin of the opening at

For the various steps of the operation see Figs. 12-40.

the base of the skull. A larger opening is unnecessary as the temporal lobe cannot be elevated more than 2 cm above the floor of the skull. I am now making a punctured wound of the dura to allow the cerebrospinal fluid to escape throughout the operation. This is a very important step as it enables the temporal lobe to be elevated with greater facility and less harmful pressure upon the brain. Now the dura is gradually sepa-

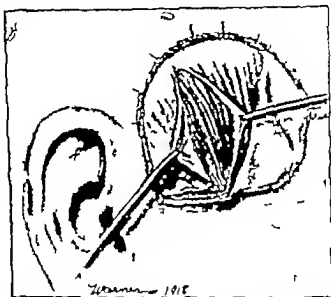


Fig. 32.—Technic of section of sensory root. Drawing showing approach to ganglion. Cutaneous flap reflected forward. Line of incision in temporal fascia and muscle is projected so that this musculo-pericranial flap may be reflected back.

rated from the inner aspect of the temporal bone both in front and behind our opening in the skull and along the base. Our first objective is the foramen spinosum through which the middle meningeal artery enters the skull. I can see the groove in the floor of the skull and will use this as a guide to the foramen. The oozing is readily controlled by these small pledgets of cotton. With this illuminated retractor the field of operation can be

but the pain was more violent. A few days of it, and he rushed back to us for another injection, more or less demoralized and dejected. He dreaded the injections, and now he began to dread a recurrence. Though given absolute relief by the third injection he was more or less apprehensive and uneasy and now realized that the injections would not cure him. Returning to business, he wondered how long it would be before he would be seized with another attack. It was only nine months, the interval of relief was shorter after each injection his morale was broken and he returned to us pleading for some permanent measure of relief and as there is no contraindication I have had him prepared for the major operation.

Now the experience of the second case is quite different and it serves our purpose well for contrast. This patient has been a sufferer off and on for only eight months. The attacks, while severe have not reached their maximum severity. He couldn't quite make up his mind to have a major operation and, as is my practice I have allowed him to make his own choice, and he has chosen the alcohol injection. As the other patient is ready for operation I will conclude what I have to say about the injection until the operation is finished.

We are using ether as an anesthetic, skillfully given by a trained nurse anesthetizer who knows every step of the operation and keeps the patient under such light anesthesia that a few minutes after the sensory root has been cut the patient will be conscious to answer questions. Note also the patient is in the sitting posture a posture we have adopted for these reasons because there is less bleeding because the patient requires less ether and because it is the most convenient posture for the operator as the field of operation is exactly on a level with his eyes.

Follow now the various steps of the operation the winged incision the cutaneous flap reflected forward the musculo-aponeurotic backward. An opening in the skull is made 3 cm. in diameter the center of the opening opposite the mid-point of the zygoma and the lower margin of the opening at

For the various steps of the operation see Figs. 12-20.

be matters of minor consideration, as compared with the primary object of the operation the relief of such intense suffering. But by conserving the motor root the operation might be said to have reached a stage of perfection. I have raised the sensory root and can see the motor root coursing behind the root and disappearing beneath the ganglion. To be sure the motor root is not mistaken for a fasciculus of the sensory root I will stimulate what I recognize as the motor root with an electrode. You



Fig 13.—Technic of section of sensory root. Show how cutaneous flap reflected forward and musculo-aponeurotic flap back and stitched to towels. Opening in skull being enlarged with rongeur forceps.

can see the temporal muscle on either side of our wound contracting. This is, of course, a convincing demonstration. Now for the final step. I elevate the sensory root on this small blunt hook and cut the root in two. It is not necessary to resect it, as it is an established fact in physiology that the nervous tissues, central to the ganglia, cannot regenerate. It is because of this that this operation is permanent in its effect, since if the root cannot regenerate there can be no recurrence of

seen even from the benches. We have reached the *foramen spinosum* and the middle meningeal artery must be divided as it stands between us and the sensory root. To control bleeding I plug the *foramen* with cotton with this simple dental instrument before dividing the artery. Were there any bleeding from the peripheral stump I could control it readily with a muscle graft. In this case it is not necessary. The next objective is the *foramen ovale*. It is not $\frac{1}{2}$ cm. away. I can see it now a little in front and on the inner side of the *foramen spinosum*. Now comes the most important step of the operation the recognition of the line of cleavage between the dura and the spinous sheath of the ganglion the *dura propria*. Wearing as I do extra lenses of two diopters I can differentiate the anatomic details much more accurately than with the naked eye. The line of cleavage is sought at the *foramen ovale* just where the third or mandibular division is given off from the ganglion. With this blunt dissection I separate these two dural processes and gradually expose the superior surface of the posterior third of the ganglion and the sensory root as far as the opening in the tentorium cerebelli through which it finds its way from the posterior to the middle fossa. To expose the ganglion and the root a linear incision is being made in the *dura propria*, and I can see now the individual fasciculi of the sensory root. The operation is now all but completed. There remains only section of the root, but before doing that I search for the motor root, as we have found recently that it is not necessary to sacrifice it.

The conservation of the motor root is a matter of some moment. Until a year ago the motor root escaped only by accident and when cut there followed atrophy of the temporal, masseter and pterygoid muscles. Atrophy of the temporal muscle implies a depression above the zygoma, which robbed the operation of what might be said to be an ideal cosmetic result. In fact, to avoid this some surgeons were in the habit of resecting the zygoma. Atrophy of the pterygoid and masseter interferes somewhat with mastication and the jaw when opened is deflected somewhat to one side. These seem to

It was first proposed by Spiller in 1901 as a substitution for excision of the gasserian ganglion a procedure attended with greater difficulties, greater risks, and a much higher mortality. The risks of the sensory root operation have been reduced to a minimum so small as to be almost negligible. In fact, in the last 175 operations in this clinic there has been but one fatality in the case of an elderly woman who in the convalescent stage,

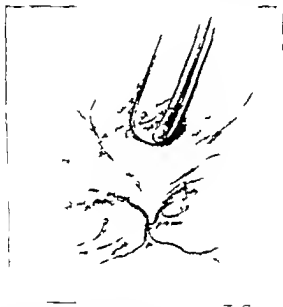


Fig. 35.—Technic of section of sensory root. Note the middle meningeal artery before its division and the outline of the foramen ovale—little in front and toward the median line (Frazer as Keen "Surgery")

that is after she was up and about, succumbed to an apoplectic seizure. Despite the fact that the patients are for the most part elderly people, you will concede that a mortality of $\frac{1}{3}$ of 1 per cent. more than compares favorably with the mortality of any other major operation which you have witnessed in your student days.

You may ask very properly what about complications and

pain. The ether can now be discontinued, as the field of operation is entirely within the trigeminal territory now a completely anesthetized zone. Before removing the retractor a survey of the field of operation may find one or more bleeding points readily controlled by tiny muscle grafts, clipped from the inner surface of the temporal muscle. The wound I close with interrupted silk sutures in four tiers. As bleeding is under control, no drainage is required. The patient you see is now recover

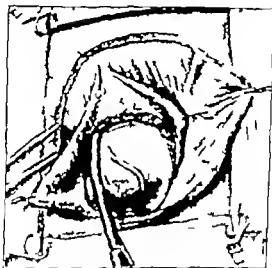


Fig. 34.—Technic of section of sensory root. Showing separation of dura from margins of bony opening.

ing consciousness and I will test the conjunctival reflex on the affected side. It is absent. The eye will be irrigated with a boric solution and special shield applied before the patient is returned to his room.

You have witnessed what I have referred to throughout this lecture as the major operation for trigeminal neuralgia. By the major operation we imply section of the sensory root, an operation universally recognized as the operation of choice and one in which in Philadelphia we have a peculiar interest, in that

occasionally the patient may be more or less intolerant to this, and in a few instances the patient may complain of certain paresthesias such as creeping and itchy sensations.

As to the permanent results there can be no recurrence if the entire root has been divided. In only one instance have I had to operate a second time and in that case I found one fasciculus had been overlooked. Let me warn you however of the unsatisfactory results that may follow the operation in cases of mistaken diagnosis this statement applies particularly to hysterical subjects who may complain of as much pain after the operation as before. Once I reopened the wound within a week of the operation and though the patient was conscious clamping the gasserian ganglion with a hemostat elicited no pain whatsoever a convincing demonstration that the sensory root had been entirely cut and all communication with the fifth root nucleus entirely severed. From every viewpoint this sensory root operation is the most satisfactory to the surgeon and most gratifying to the patient of any we are called on to perform.

Now let us return to the subject of alcoholic injections. A number of years ago when for one reason or another the major operation was not indicated, it was our practice to remove by avulsion one or the other of the peripheral branches usually the supra-orbital, the infra-orbital, or the inferior dental nerve. Recurrence usually within the year was the rule. With the exception of that on the supra-orbital nerve, the others have been entirely abandoned in favor of deep alcoholic injections for various reasons. In the first place with the alcoholic injections we reach the main division, that is the maxillary and mandibular and thereby control pain in all their branches in the second place, there is not the formality of an operation, with all that it implies a general anesthetic and a wound the scar of which will be more or less conspicuous and in the third place, the effect of the alcoholic injection may be more lasting.

As to the indications, I have already told you that in major trigeminal neuralgia I prefer that the patient decide whether he will have the major operation or the injection. There are occasions, however when there is a reasonable doubt as to the

end results. As to complications there are but two (1) Transitory facial paralysis of only occasional occurrence, the cause of which is a matter of speculation but as the paralysis is only transitory it gives us no concern. (2) Trophic keratitis. This is a matter of more serious concern but, fortunately one which responds to appropriate treatment. As prophylactic remedies we use routinely boric acid irrigations, instillations of bolocain, and atropin, remedies in which I must confess having little



Fig. 36.—Technic of section of sensory root. The locum externum is plugged with cotton and middle meningeal artery divided about ligature (Frazier in Keen "Surgeon.")

faith. But should there be any exfoliation of the corneal epithelium the lids should be closed at once and kept closed by suture if necessary until the corneal defect is repaired. In upward of 300 major operations there has been but 2 cases in which it has been necessary to keep the lids closed. The patient should be informed before the operation that the anesthesia of the trigeminal zone will be permanent. In most instances the patient gladly accepts numbness as a substitute for pain, but

Before proceeding to inject the patient I have previously shown you let me make a few general remarks as to the technic of injections. Because the knife is not used do not fancy for a moment that the undertaking is one you can venture upon without due preparation. By preparation I mean practice upon the cadaver and a study of the anatomy that will enable you to visualize the structures which the needle must penetrate and the

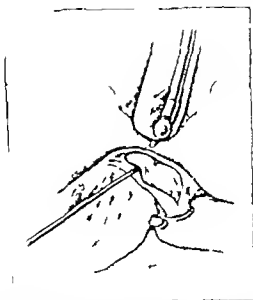


Fig. 33 — Technic of section of sensory root. The sensory root is elevated with hook and beneath it one looks for the motor root. The motor root should be identified before the sensory root is cut. (Frazer to Keen "Surgery")

Important anatomic structures in close proximity. Because of anatomic variations I consider it still abundant as my experience has been, an exceedingly difficult undertaking and if given the choice would elect the major operation. As a matter of fact at the first attempt at injection at the first sitting you must be prepared for failure. In fact, when a patient comes to the clinic from out of town I insist upon his planning to remain in the hospital at least a week as the injection if not at first

diagnosis, and under these circumstances it is a very good plan to give an alcoholic injection. If the patient has the inguinal neuralgia of the kind that will be relieved by the operation, he will enjoy immediate relief after a successful injection and will at the same time experience the numbness that he must expect as a permanent affair after the major operation. If the case is not one of the type appropriate for the major attack the patient

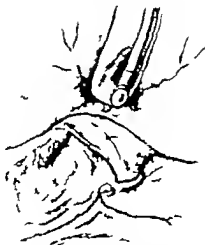


Fig. 37.—Technic of section of sensory root. The foramen ovale marks fibular division, posterior third of ganglion and sensory root is held. The incision is the dorsa propria. (Frazier in Kees "Surgeon.")

will not be relieved of pain at all, he may complain of pain in another region or of a different kind of pain or as is not unusual, may complain more bitterly of pain after the injection than he did before. This should be interpreted as a warning by the surgeon and as an absolute contraindication to any operative undertaking. But there are minor forms of neuralgia which do not respond to other remedies when the pain is intense enough to warrant an alcoholic injection.

If not forewarned the inexperienced may be somewhat chagrined by some unpleasant consequences. Puncture of the middle meningeal or the branches of the internal maxillary artery will be followed by extravasation of blood. Trauma of the pterygoid muscles or the injection of alcohol into the muscles in ineffectual attempts will be attended with stiffness of the jaw. If the eustachian tube has been penetrated by the needle

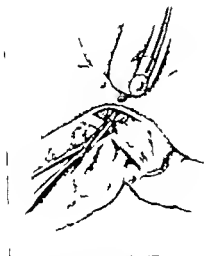


Fig. 40—Technic of section of sensory root. The dura propria reflected. Sensory root elevated on hook and root sectioned with sharp bistoury (Frazer in Keen "Surgery")

the patient may complain of deafness or vertigo and occasionally the needle or the alcohol may damage the third or sixth cranial nerves and determine an oculomotor or abducens palsy. These, however, are only transitory.

The patient is now ready for an injection of the second and third divisions. In this clinic our practice differs from that of others in that the injection is given under nitrous-oxid anesthesia. There is no reason in experienced hands why a general

successful must be repeated. By successful injection I mean one in which $\frac{1}{2}$ to 1 c.c. of the solution (I use 95 per cent. or absolute alcohol) actually penetrates the nerve sheath and is diffused within the nerve fasciculi. If an insufficient amount is injected the effect may be only transitory the pain may be immediately relieved and there may be a transitory anesthesia in the terminal distribution of the nerve but in forty-eight

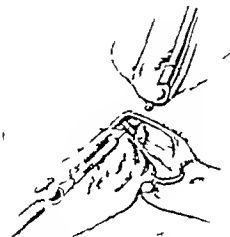


Fig. 39.—Technic of section of sensory root. The sensory root has been divided and reflected over the ganglion, exposing the motor root to which the electrode is being applied. (Frazier in Keen "Surgery.")

hours the pain will return. Usually one can tell whether the injection has been successful in two ways: if the needle is actually within the substance of the nerve considerable force will be required to empty the syringe and after the injection a test with the needle will elicit total anesthesia in the zone supplied by the nerve injected. It is assumed of course that pain is instantly and absolutely relieved.

in the substance of the nerve, the syringe charged with 1.5 cm of 95 per cent. alcohol is attached to the needle and to advance the plunger I must use a great deal of force. This assures me that the alcohol is being diffused in and not about the nerve. Had I failed in the first attempt I would not have withdrawn the first needle, but made the attempt with a second needle varying the direction first a little forward of the first needle and failing in this, a little backward. For the second division the needle enters the skin at the 3.5 cm. point on our scale and is directed upward and forward in the direction of the spheno-

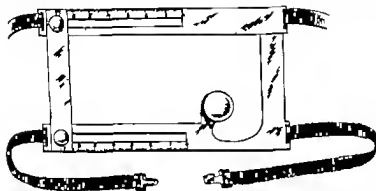


Fig. 42.—The sygoneter used in alcoholic injections. The fixed point is the external auditory meatus, which the button fits. One measures along the scale for points at which the needle is to be introduced, instead of measuring from bony prominences which are difficult to locate.

maxillary fissure. This is a more difficult injection because the nerve trunk is smaller and it is not so easy to visualize the proper direction, and in the knowledge that in 70 per cent. of cases the nerve cannot be reached there is this element of uncertainty in the mind of the operator when he fails at the first or second attempt. The needle has penetrated a distance of 5 cm. and as I advance the plunger the alcohol escapes so readily that I am sure the point of the needle is not in the nerve trunk. I take a second needle and direct it a little more upward and you see the patient is moving. Though unconscious of pain patients

anesthetic should not be used and the patient spared the most intense and acute suffering. If performed in the conscious state the ordeal is so distressing that in the event of the inevitable recurrence the patient so dreads the thought of a second injection that he will put it off as long as he can endure the pain. Our technic differs in another particular in that we use this special device, we have styled a xygometer on which we can



Fig. 41.—Cosmetic result in patient after operation. The incision is covered without the hair line broken from view.

see by the graduated scale the point at which the needle should penetrate the skin. The patient is now under the anesthetic. I disinfect the skin with alcohol, and to reach the mandibular division I enter the needle at the 2.5 cm. mark, thrust the needle directly inward and slightly upward. The needle has penetrated the tissues to a depth of 4 cm. and feels as though it had met with greater resistance. To see whether the needle is

in the substance of the nerve the syringe charged with 1.5 cm. of 95 per cent. alcohol is attached to the needle and to advance the plunger I must use a great deal of force. This assures me that the alcohol is being diffused in and not about the nerve. Had I failed in the first attempt I would not have withdrawn the first needle but made the attempt with a second needle, varying the direction first a little forward of the first needle and failing in this, a little backward. For the second division the needle enters the skin at the 3.5 cm. point on our scale and is directed upward and forward in the direction of the sphen-

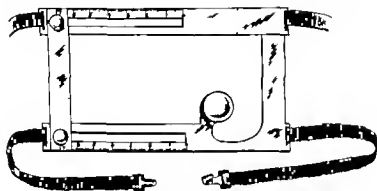


Fig. 42.—The syrometer used in alcoholic injections. The fixed point is the external auditory meatus in which the button fits. One measures along the scale for points at which the needle is to be introduced, instead of measuring from bony prominences which are difficult to locate.

maxillary fissure. This is a more difficult injection because the nerve trunk is smaller and it is not so easy to visualize the proper direction and in the knowledge that in 20 per cent. of cases the nerve cannot be reached there is this element of uncertainty in the mind of the operator when he fails at the first or second attempt. The needle has penetrated a distance of 5 cm. and as I advance the plunger the alcohol escapes so readily that I am sure the point of the needle is not in the nerve trunk. I take a second needle and direct it a little more upward and you see the patient is moving. Though unconscious of pain patients

are subconsciously disturbed when the needle impinges on the nerve or when the alcohol is injected. In the second attempt the alcohol has evidently reached its proper destination we let the patient come out from the effect of the anesthetic and test for anesthesia. Thrusting a needle in the upper and lower lips, gums, tongue and hard palate you see causes no pain whatsoever and the patient says his cheek and tongue feel swollen. This is a very telling test of a successful injection and a bit of information usually volunteered by the patient.



Fig. 43—Rough sketch showing the sygonometer in place (See Fig. 42.)

I have but one more demonstration to make in conclusion, an injection of the gasserian ganglion in patient under treatment by Dr. Pancoast in the x-ray department, for extensive carcinoma of the face. I have already told you how I felt toward patients with these often hopeless lesions. The tendency on the part of the surgeon to scrap these miserable subjects is too well known, they deserve more consideration. We use Härtel's technique with slight modifications, and as before inject under nitrous-oxid anesthesia. Note that I have drawn two lines on the face from the point at which the needle

is introduced 2 cm from the angle of the mouth one of these extends in the direction of the pupil, the other toward the articular eminence of the zygoma. These lines represent the two planes in which the needle must be directed that the needle must not be directed more medialward than the pupillary line and not on a lower plane than the line to the articular eminence. Of these two the latter is the more important, as the needle could readily penetrate the jugular foramen and vein if this restriction was not observed. As with injections of the second and third divisions, injection of the ganglion should not be undertaken without due preparation. There is much that comes from practice and experience that cannot be conveyed in the printed dictum. I advance the needle in the prescribed plane and at 6 cm. I can feel the needle entering the mandibular division. At this point where the nerve is making its exit through the foramen ovale, I will begin to inject the alcohol, and slowly advance the needle a distance of 2 cm into the ganglion. Stopping at intervals of 0.5 cm and at each interruption rotating the needle so that the eye of the needle faces various directions. This ensures a more widespread diffusion of the alcohol throughout the ganglionic tissue.

The subject of ganglionic injections must not be left without a warning as to the incidence of keratitis. In Hartel's original series keratitis developed in 25 per cent. of his cases. This is a serious matter and is sufficient to condemn this method in the treatment of major trigeminal neuralgia. There are those who would have us adopt alcoholic injections as a substitute for the radical operation, but the incidence of keratitis is prohibitive. Furthermore while the alcoholic injections of the ganglion give longer periods of relief than injections peripheral to the ganglion, the effect is by no means uniformly permanent, so that this treatment cannot be regarded as a radical cure and therefore not in any sense as a substitute for section of the sensory root. But in dealing with the pain from these advanced cases of carcinoma one hesitates to urge the major operation, and feels justified in view of the otherwise hopeless condition of many of

these patients of incurring the risk of corneal complications. At least this has been our policy.

Let me now briefly summarize the ground I have covered.

We have given a classification of various types of neuralgia so that you may be able to distinguish those which may be relieved by operation upon the trigeminal nerve and those which may not. Briefly referring to the pathogenesis of major trigeminal neuralgia we dwelt upon the choice of method in its treatment whether by alcoholic injections or by operation. You witnessed the major operation—section of the sensory root of the gasserian ganglion—and were told the immediate and end-results. Finally the difficulties and complications of alcoholic injection were dwelt upon and the technic of injecting the second and third divisions and the ganglion itself was demonstrated.

CLINIC OF DR. ASTLEY P C ASHHURST

EPISCOPAL HOSPITAL

BIRTH INJURY OF THE RIGHT SHOULDER, NEUROLYSIS OF THE BRACHIAL PLEXUS

THE first patient for operation this morning is a girl who is now ten years old. She came under my care in September 1913 when she was three years of age. There were two other children the first (at that time seven years old) had had the left shoulder broken in birth. The second child then six years old had the nerve hurt in birth (right shoulder) but it came all right about six weeks after birth. A fourth child born after I first saw the present patient was killed during delivery. There was evidently need in this family for some advance in obstetrics. The two older girls whom I examined subsequently both presented the typical picture of birth injuries of the shoulder but in such mild degree that very little disability remained and no treatment was indicated. This patient, Catherine, was born head first and no instruments were used. she seemed at birth to have no sensation in the left arm and it had always been utterly useless. She chewed the fingers until they bled and burned the hand several times without evincing any sensations of pain. As you will see, the finger nails still show marked lack of development, an indication of interference with their nutrition (Fig 44). There was when I saw the child first, complete flaccid paralysis of the left upper extremity. I thought at the time the lesion was a tearing out of the roots of the brachial plexus from the spinal cord. She had already been seen by nerve specialists and orthopedic surgeons, who told the mother nothing could be done. Owing to the complete absence of sensation which had persisted for over three years this seemed reasonable advice and it was repeated. Nine months

after my first examination of this child I sent for her again, especially as it had not been noted at the first examination whether or not there was a posterior dislocation of the shoulder. You will recall that birth injuries of the shoulder such as this child presents have been, from the time of Duchenne (1872) and Erb (1874) considered as due to nerve lesions occurring in the brachial plexus and most frequently involving the fifth and the sixth cervical roots. Although Kistner in 1889 stated that all such cases seen by him really were instances of separation of



Fig. 44.—Trophic changes in the nails in case of laceration of the brachial plexus (birth injury)

the upper epiphysis of the humerus and although Whitman in 1905 called particular attention to posterior dislocations of the shoulder often associated with this condition, it was not until T. Turner Thomas, that chronic disturber of the peace, turned his attention to these cases and proposed (1910) the theory to which he still adheres that the supposed paretics are secondary to a primary lesion of the capsule of the shoulder joint. It was not, I say, until T. T. Thomas began his studies of this subject that it took on a new interest for surgeons. His theory is that the effused blood, lymph, and synovial fluid catch the nerves in

connective tissue and that the dislocation so frequently accompanying these birth injuries is primary and therefore the cause, not the result, of the brachial palsy. Similar teachings were subsequently (in June, 1912) promulgated by Lange but neither Lange nor Thomas has been able to secure general recognition of the truth of this doctrine.



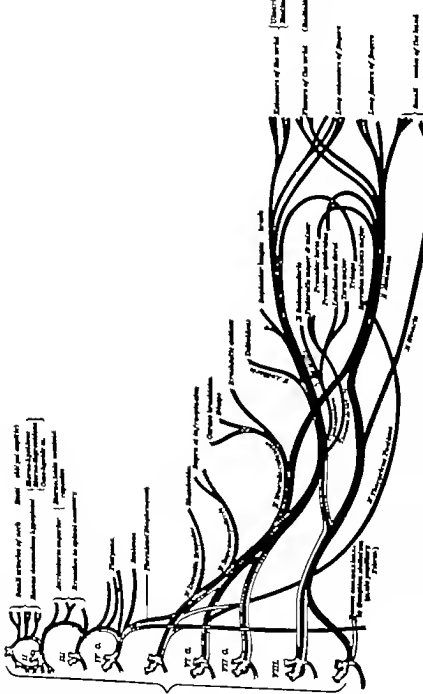
Fig. 45.—Paralysis from laceration of brachial plexus (birth injury)

From the observations which I have made myself in this class of cases, number of which I reported in 1917 (*Annals of Surgery* 1918 I 25) it seems to me that, while the majority of birth injuries of the shoulder have a peripheral lesion of the nerves immediately surrounding the shoulder joint, probably due, as Thomas says to an original trauma to the joint proper

yet there certainly are cases where the lesion is in the roots of the brachial plexus, and, as I have stated before, the patient I am about to operate on, in my opinion, belongs to this class. When I saw her for the second time in June 1914, when she was past four years old, I learned that the child had not burned her fingers since Christmas and that after the first of the year she had begun to move her fingers. She could then (that is, in June, 1914) flex the shoulder slightly the axillary fold muscles had fair power there was some power in the biceps, and she could extend the wrist well. There was a subacute dislocation of the humerus. Operation was recommended at that time to secure reduction of the dislocation, since it had been determined by an experience with reduction of a number of similar dislocations that a considerable degree of improvement might be expected in apparently paralyzed muscles if deformities were overcome and the weak muscles were allowed to work at better advantage.

Accordingly in December 1914 reduction of the dislocation of the shoulder was accomplished by open incision, but although the dislocation stayed reduced it was noted a year after the operation that there was very little improvement in the power of motion and no more has been regained since (Fig. 45).

Now the operation today will consist in exposing the brachial plexus and determining if possible what lesions exist. As the paralysis is confined to the hand and forearm (Dejerine-Klumpke type) it is evident that the disabling lesions are in the lower roots of the brachial plexus (seventh and eighth cervical and first dorsal—Plate II). It is not likely I believe, that much good can be accomplished but it is justifiable to make the exploration. The patient being etherized and the neck extended over a sand-bag I make an incision about 8 cm. long above and parallel to the left clavicle. The omohyoid muscle is found and divided, also the suprascapular and transversalis colli arteries and veins are doubly ligated and divided. Next the lateral margin of the anterior scalene muscle is identified and you will see here the phrenic nerve overlying it. By following the phrenic nerve upward to its origin in the fourth root of the



cervical plexus it is easy to identify the fifth and the sixth cervical roots, emerging between the anterior and middle scalene muscles (Fig 46). There is much scar tissue involving their junction with the seventh. This is dissected free. By turning this mass of scar tissue laterally I can expose here deeper in the

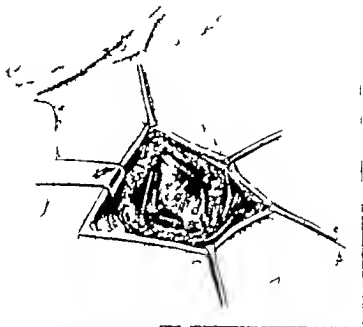


Fig 46—Brachial plexus exposed, showing scar tissue involving fifth and sixth cervical roots. Note subclavian artery phrenic nerve (on anterior scalene muscle) suprascapular artery ligated and cut, and small nerve descending to supply subclavius muscle

neck dense scar tissue involving the roots of the seventh and eighth (Fig 47). Here you see, also, is the subclavian artery. I have accidentally wounded the pleura as a little whiff of air enters the wound. No symptoms are produced and the pleura will heal without difficulty. Temporarily a gauze sponge is placed over

the puncture. It is impossible to find the first thoracic root which should lie just posterior to the subclavian artery and I presume it has been torn off within the vertebral canal (Fig. 48). Having cleared up the scar tissues as far as possible, and in so doing having intentionally divided the nerve to the subclavius muscle which is of very little significance I will stimulate the nerves with the faradic current in an effort to determine whether any motion is transmitted to the hand. These nerves, the fifth



Fig. 47—Scar tissue involving fifth and sixth cervical roots dissected free and turned laterally



Fig. 48—Completed dissection of roots of brachial plexus. Note partial rupture of eighth cervical and absence of first dorsal root

and sixth, in spite of the scar tissue, transmit the faradic impulse very well, but cause no motion below the elbow. Faradic stimulation of the seventh and the eighth roots is also transmitted chiefly to muscles above the elbow but at times we think there is slight extension of the fingers, but this is doubtful. The nerve-fibers which supply the small muscles of the hand and the flexors and extensors of the wrist should pass through the seventh and the eighth cervical and first thoracic (Plate II)

Of course, if these nerve-fibers have been cut off from their central connection since birth it is not likely that faradic stimulation of their peripheral ends even below the scar tissue in the plexus and as far down as I can reach under the clavicle—it is not likely I say that such stimulation will be transmitted to the paralyzed muscles. I do not think there is any more I can do at this time. I will take a pedunculated flap of fat from the region of the trapezius and pass it beneath the roots of the fifth



Fig 49—Flap of fat drawn beneath roots of fifth and sixth cervical and over those of seventh and eighth roots



Fig 50—Exophthalmos from involvement of sympathetic nerve in laceration of roots of left brachial plexus

and the sixth and over those of the seventh and eighth in order to prevent, if possible the re-formation of such dense scar tissue (Fig 49). The platyana is now closed with interrupted chromic catgut and the skin with a continuous suture of the same material.

I have operated on two adults with similar lesions and in neither of them have I been able to do any more than in this child. In one of them it was evident that the fibers connecting the first dorsal root with the sympathetic nerve were involved

as there was slight enophthalmos and contraction of the pupil (myosis) on the same side (Fig 50). If anything can be done for this child in the future it will probably consist of the transplantation of nerves below the clavicle transplanting one or more of the active nerves which supply relatively unimportant muscles into the nerves the median and the ulnar (especially the median) which supply the small muscles of the hand. Her upper extremity certainly will be more useful with the hand active and the shoulder paralyzed than as it is now with the shoulder active and the hand paralyzed.

(The first dressing on this patient was made a week after operation. The wound was healed and she was allowed to go home returning to the dispensary for treatment with massage and electricity.)

FRACTURE OF THE TIBIA: OPEN REDUCTION

THE second case this morning is an irreducible fracture of the left tibia and fibula above the ankle joint (Fig 51) The child, who is eleven years old was admitted to the hospital on October 26th having fallen into an excavation being made for a moving picture theater She says she fell about 10 feet in



Fig 51—Irreducible fracture of tibia and fibula

height On admission a few hours after the injury it was found that there was marked swelling over the lower half of the left leg with ecchymosis and blebs on the inner side There was crepitus and preternatural mobility The leg was put in a fracture box in the receiving ward and the patient was sent to the Children's Ward

On November 1st I took over the service from Dr. H. C. Deaver under whose care the child had been up to that time. Two different attempts had been made on Dr. Deaver's service to secure reduction of the fracture which, as the x ray showed, was in a very bad position (Fig. 51). When I saw her it was

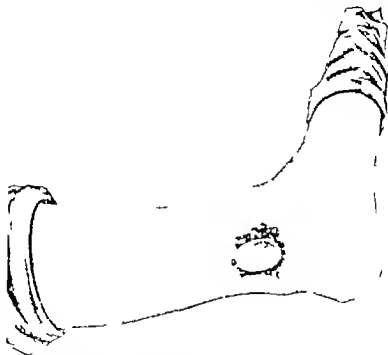


Fig. 52.—Fracture of tibia and fibula above ankle showing large blebs with surrounding ecchymosis, present on admission. (See also Figs. 51 and 53.)

evident that open reduction would have to be done, but in order to do this it was necessary to have the soft parts in reasonably good condition, and as we planned to do the operation about ten days after the injury we began the preparation two days before the time set, first washing the leg as if for an operation, puncturing the large blebs over the internal malleolus with a

scalpel (Fig 52) and applying a soap poultice to the entire limb from the knee to the end of the toes. Whenever the skin is very dirty and you wish to soften up the superficial layers of the epithelium and mechanically cleanse the leg there is nothing quite as satisfactory to use as a soap poultice. This is made by



Fig. 53—Skilagraphs after open reduction of fracture shown in Fig. 51

melting half a cake of Ivory soap in just enough water to dissolve it. This is heated on a water-bath, and when solution is complete a teaspoonful of sugar and one tablespoonful each of ether and of alcohol is added. The resulting poultice should be of the consistence of soft ointment.

After washing and shaving the part in the usual way this

poultice is applied thickly covered with sterile gauze, and left in place for twenty-four hours at least. This should be done at least two days before the time set for operation. A bleb such as this girl had should be treated, even before the soap poultice is applied, by puncturing allowing the epiderm to fall back on the skin beneath and covering the surface with sterile powder. When the skin has been dry for twenty four to forty eight hours then it is safe to begin the preparation for operation with the soap poultice.

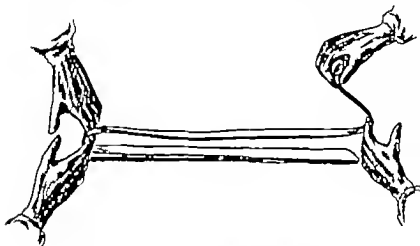


Fig. 54.—Method of making splints from plaster of Paris.

The day before the operation the leg is again washed with soap rubbed with alcohol and with bichlorid, and tied up in dry sterile gauze or (for economy' sake) in a dry sterile towel. We always prepare a very much larger area than we intend to expose at operation. In this child for instance with fracture of the lower third of the tibia, the leg has been sterilized from above the knee to beyond the ends of the toes. And in all operations on bones and joints I have the part formally prepared twice on two separate days.

Through a curved incision over the anterior surface of the tibia and convex laterally the tibia is exposed and the periosteum

divided with another scalpel. The wound margins are excluded with sterile towels and the fracture reduced by grasping the end of the upper fragment with a Lambotte forceps and manipulating the lower fragment into place by means of the

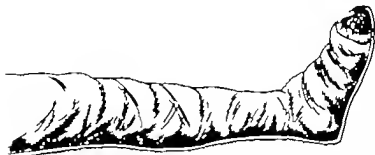


Fig. 55—The first plaster-of-Paris splint is applied posteriorly and bandaged in place

foot. No fingers are put into the wound. Nothing is done to the fibula. Almost invariably the fibula will take care of itself in fractures of the shafts of the leg bones. As the fracture shows little tendency to become displaced it will not be necessary to



Fig. 56—The other plaster-of-Paris splints are applied around the foot and along the sides of the leg

fix it by plate or other means. The deep fascia and the skin are closed separately and after a sterile dressing is applied plaster-of-Paris splints freshly made are used for fixation. The splints are easily made by folding the bandage back and forth

until a sufficient thickness is secured (Fig 54) Two bandages will be enough for each splint in a leg of this size. The first plaster splint, still soft and wet is adjusted posteriorly over the popliteal space, down the leg under the heel and up the sole of the foot to beyond the toes (Fig 55) It is then bandaged securely to the leg with flannel bandages while a second splint is being made. The second splint starts on the dorsum of the foot over the *first metatarsal bone* passes outward over the dorsum of the foot, around the sole and up the median side of the leg to the knee. It likewise is bandaged with flannel bandages. The third splint starts on the dorsum of the foot in the region of the fourth metatarsal, passes inward over the dorsum of the foot, across the sole and up the outer side of the leg to the knee. It also is covered with a flannel bandage. While they set I will continue to hold the leg in what I believe is the correct position but we will have further x rays made after the setting is complete and ascertain what position the bones are in at that time (Fig 53)

These splints, originally introduced, I believe by Dr Stimson, of New York City are a great convenience in that being made to order and fitted accurately they are efficient. As soon as the setting is complete the patient can leave his bed, go around the ward in a wheel chair and consider himself convalescent.

By inserting a layer of flannel bandage between each splint as it is applied each splint can be removed separately in order to dress the leg, for it is important not to leave a leg or arm or any fractured part done up immobile in plaster of Paris indefinitely. In certain fractures it may be necessary. In those of the hip for instance, it is better after the fracture is reduced and a plaster cast applied in abduction to leave it on until union is secured than to attempt to take it off too soon for the sake of securing mobility in the knee or the hip. But as a rule, in fractures such as those of the hip the damage to the soft parts by the original injury is very slight, and if reduction is promptly secured there is little or no swelling and there is less need therefore, for attention to the soft parts during the course of treatment than in fractures of the legs forearm or elbow where the swelling may be marked

Now I want to call to your attention, in connection with fractures, the very scandalously bad results that actually occur. A number of years ago the American Surgical Association became convinced of the necessity for establishing some uniform record for fracture cases in order that deficiencies in treatment and in end results might be recognized. Their Committee on Fractures in 1915 succeeded after much difficulty in collecting from various parts of this country and Canada records of nearly 2000 cases of fracture of the long bones. Of these, only 829 were reported in sufficient detail for purposes of investigation. From a study of these cases they found that the average period of disability was very much longer than anyone realized, that is to say the average period during which the patient was incapacitated for work.

TABLE I

Average Period of Disability

Humerus, shoulder	11.5 weeks
Humerus, shaft	14.0
Humerus, elbow	9.0
Radius and ulna, shafts	10.8
Femur neck	8.1 months
Femur shaft	7.1
Tibia and fibula shafts	4.9
Ankle	4.9

This table (Table I) which I present now shows the average period of disability and you will be surprised to learn that in the average case of fracture of the leg for instance it will be five months before your patient is able to resume his normal occupations. That is to say if I should break my leg this afternoon going home from the hospital it would be the first of April under ordinary circumstances before I would be able to walk about on it again as I am doing today.

Now it is incumbent upon surgeons to endeavor by all means in their power to reduce this period of disability. The further investigations of the Committee on Fractures of the American Surgical Association involved answers to the following questions

Does a good anatomic result lessen the period of disability? Their records showed that if good anatomic results are obtained 69 per cent. of fractures of the femur will recover function within six months, as compared with 53 per cent. if the anatomic result is moderate, and only 38 per cent. if the anatomic result is bad. When good anatomic results were obtained in fractures of the leg bones 92 per cent. of patients recovered function within six months, as compared with 80 per cent. if anatomic results were moderate, and only 25 per cent. if the anatomic result was bad.

TABLE II
Fractures of the Long Bones

Anatomic result.	Total.	Functional results		
		Good.	Moderate.	Bad.
Good	409 (57%)	397 (83%)	61 (13%)	11 (2%)
Moderate.	251 (30%)	126 (50%)	98 (39%)	27 (10%)
Bad	109 (13%)	22 (20%)	26 (24%)	51 (50%)
Total	829 (100%)	545 (65%)	185 (22%)	99 (12%)

This next table (Table II) shows the anatomic and the functional results secured in these 829 cases which were investigated by the American Surgical Association. It is scandalous, in the first place, to notice that only 57 per cent. of the patients secured good anatomic results. That is to say in 43 per cent. of the cases accurate reduction was not obtained, and of the whole number of the fractures only 65 per cent. secured a good functional result. The table clearly shows that good function depends very largely upon accurate reduction of the fractures. But you will see and it is true, that fractures in children under fifteen years of age do not require to be reduced with as great accuracy as fractures in adults let us look for instance at the tables (Table III) published by this Fracture Committee, classing in one category all the patients under fifteen years of age and in another all those over fifteen years of age we come to this startling result, that whereas 87 per cent. of the children secure good functional result only 52 per cent. of the adults secure good function. This difference is due largely to the fact that reduction, accurate anatomic reposition of the fragments,

is by no means so important in children as in adults, although, as you will see from this table, it was secured in 70 per cent. of the children while it was secured in only 49 per cent. of the adults.

TABLE III

I. Influence of Age on the Functional Result

Anatomical result, under fifteen years.	Total.	Functional results		
		Good	Moderate	Bad.
Good	221 (70%)	209 (94%)	11 (5%)	1 (0.5%)
Moderate.	80 (25%)	63 (79%)	15 (18%)	2 (2%)
Bad	17 (5%)	6 (35%)	3 (17%)	8 (4%)
Total	318 (100%)	278 (87%)	29 (9%)	11 (3%)

Anatomical result, all over fifteen years.	Total.	Functional results		
		Good.	Moderate.	Bad.
Good	248 (49%)	183 (75%)	50 (20%)	10 (4%)
Moderate.	171 (33%)	63 (37%)	83 (48%)	25 (14%)
Bad	92 (18%)	16 (17%)	23 (25%)	53 (57%)
Total	511 (100%)	267 (52%)	156 (30%)	88 (17%)

How are we to secure accurate anatomic reduction in fractures? In most fractures near joints it is possible to secure reduction bloodlessly and to maintain the correct position of the fragments by the position in which the limb is dressed—note what I say—first secure reduction and then maintain it by proper position. Let me show you these x-rays of an ordinary supracondylar fracture of the humerus (Fig 57) which the physician in charge thought he had reduced merely because he dressed the elbow in acute flexion. As you will see the fracture was not reduced (Fig 58) but after it had been properly reduced (Fig 59) you see at once how securely reduction is maintained by the position of hyperflexion, as I call it not merely of acute flexion. And it is a thing which is not appreciated as it should be by the profession, that many joint fractures require considerable force for reduction to be secured but *one must not apply the force blindly* first unlock the fragments, usually by increasing the deformity already present then make longitudinal traction until they pass into proper relation the one to the other and finally maintain the reduction by the position in which the limb is dressed. In this

elbow for example, to secure reduction (which had failed in the previous attempt by another physician) I at first *hyperextended* the elbow unlocking the joint fragment from the shaft then I made *longitudinal traction* upon the forearm, in the slightly hyperextended position, until I thought the lower fragment was



Fig. 57—Supracondylar fracture of the humerus, on right-angled splint, before attempted reduction. (*see Figs. 38 and 39)

pulled past the end of the shaft and finally I brought the forearm up on to the arm directly in the sagittal plane (neither in adduction nor in abduction) into the position of hyperflexion, and by this term I understand *flexion as acute as possible*. If the reduction is accomplished soon after the injury no anes-

thetic may be necessary but when previous attempts have proved unsuccessful, it is usually wise to have the patient anesthetized. But even in some joint fractures and in very many



Fig. 58.—Supracondylar fracture of the humerus, after attempted reduction the elbow is in acute flexion, but not in "hyperflexion." (See Fig. 59)

fractures of the shaft of long bones it is impossible to secure anatomic reposition by manipulation. And in many shaft fractures I maintain that such reduction such absolute anatomic reposition, is not necessary to secure good function. This, of

course, is particularly true in children but, even in them fractures near joints should be brought into as absolute anatomic reduction as is possible.

If we cannot secure reduction without operation what are the results of operation The Fracture Committee of the American



Fig. 59—Supracondylar fracture of the humerus—reduction secured, elbow dressed in "hyperflexion." Note also that the anteroposterior view (on right) shows forearm bones and humerus nearly in same plane and compare this with the anteroposterior view in Fig. 58.

Surgical Association found that even by operative means anatomic reposition was secured in less than three fourths of the cases. In 72 per cent. only of those in which operation was done and they further found that if anatomic reposition is not to be

secured but only approximate reduction is to be obtained, very much better function follows non-operative than operative treatment—55 per cent. of good function compared to 21 per cent. Therefore it is evident that unless anatomic reposition of the fragments is obtained by operation the slight improvement in

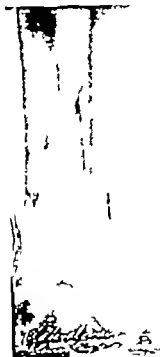


Fig. 60—Spiral fracture of tibia in lower third, lateral view

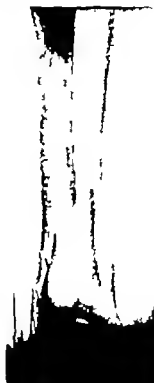


Fig. 61—Spiral fracture of tibia in lower third, anteroposterior view

the position of the fragments that is obtained thereby does not compensate for the additional injury to the soft parts entailed by operation. So that I will beg of you that when you propose doing an operation on a fracture you will stop to consider whether you are reasonably certain of obtaining accurate anatomic re-

course, is particularly true in children but, even in them fractures near joints should be brought into as absolute anatomic reduction as is possible.

If we cannot secure reduction without operation what are the results of operation? The Fracture Committee of the American



Fig. 39.—Supracondylar fracture of the humerus—reduction secured, elbow dressed in "hyperflexion." Note also that the anteroposterior view (on right) shows forearm bones and humerus nearly in same plane, and compare this with the anteroposterior view in Fig. 58.

Surgical Association found that even by operative means anatomic reposition was secured in less than three-fourths of the cases—in 72 per cent. only of those in which operation was done—and they further found that if anatomic reposition is not to be

of the shaft of long bones. In the shaft fractures bad functional results follow bad anatomic results only in half the cases whereas in joint cases a bad anatomic result insures a bad functional in over three fourths of the cases (77 per cent.)

Now these figures being known and before the profession since 1915 it is incumbent upon all surgeons to ascertain in the first place what are the results of their own treatment of fractures and if they are any better than the average they should by all means let the profession know about it.

This child upon whom I have just operated I am quite sure will secure a return of function in less than the average time, that is to say it will not be five months, it will not be three months I believe before she is walking around on her leg as if it had never been broken. I have recently had under my care a physician who fractured his leg walking along the street, and I told him that looking at his x rays (Figs. 60-61) it was evident that unless accurate anatomic reduction was secured he would be "out of work" and he would be unable to walk as he walked before he broke his leg for at least four and perhaps five months, but that it seemed to me in his case if the fracture was reduced by operative means he would secure full return of function within three or at the most four months. And as you see in the x-rays (Figs. 62-63) which I show you, taken after operation, accurate anatomic reposition was secured and the patient is now walking about, ten weeks after operation, using a cane merely as a matter of self protection and I believe that very shortly he will be restored to his original excellent condition.

duction. If not, you will do better to leave the fracture unreduced.

But, as I said before, there is a great difference between the *fractures of the shafts and joint fractures* for it is very much more



Fig. 62.—Fracture shown in Figs. 60 and 61 after operation. Lateral view

Fig. 63.—Fracture shown in Figs. 60 and 61 after operation. Anteroposterior view

important to secure accurate anatomic reposition of the fragments in the case of joint fractures than in the case of fractures

RECURRENT POSTERIOR DISLOCATION OF THE HIP FOLLOWING INFANTILE PARALYSIS, PARALYTIC VALGUS OF THE RIGHT FOOT AND CALCANEO- VALGUS OF THE LEFT FOOT

THE next patient, who is now being etherized, is a boy eleven years old, who had an attack of infantile paralysis at the age of nine months. He has worn braces ever since he began to walk.

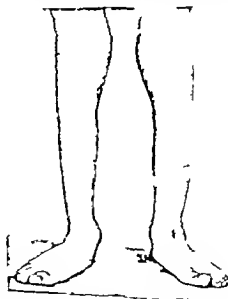


Fig. 61.—Talipes valgus on the right and calcaneo-valgus on the left following infantile paralysis.

His family never consulted any physician for the disability which remains but someone who is interested in the family complied with his wish that something should be done for his disability. I am told that some night when he was 11

peroneal and the posterior tibial tendons ride forward on the surface of and almost anterior to the malleoli owing to the marked descent of the heel, which is so great, the boy tells me, that in drawing on his long legged drawers he always has to put his heel in first, the foot lying up close along the anterior surface of the leg (Figs. 67-68)

I propose today to operate on the right hip and the right foot, and at a second sitting a week or ten days hence, to operate



Fig. 66.—Very slight adduction and flexion allow dislocation of the femur upward and backward.

on the left foot. I have had 2 patients before with recurrent paralytic dislocations of the hip one a boy of five years, the other a girl of seventeen years. In both of them the condition was relieved and the dislocation remained reduced when last heard from (after intervals of eighteen months and nearly two years, respectively) by plecting the capsule of the hip-joint. I make an incision from the anterior superior spine of the ilium to the great trochanter divide the fascia lata and the tensor

he prays to the "Good Man Above," as his caretaker expresses it, that something will be done to improve his locomotion. He is very unsteady on his feet even wearing the braces, which extend to the middle of his thigh. Both feet incline to valgus (Fig. 64) he walks with a bilateral sway and examination shows that the right hip slips in and out of the acetabulum when the thigh is adducted and slightly flexed (Figs. 65-66). Except for a little weakness of the internal rotators of the right hip there appears



Fig. 65.—Right hip is now in acetabulum.

to be no paralysis except in the foot. This right foot is in marked valgus. There is paralysis of the anterior and posterior tibial muscles and weakness of the calf muscles. There is overaction of the extensor proprius hallucis, which is endeavoring by hyperextending the great toe to supplant the anterior tibial in raising the toes from the ground as the child walks. The left foot is in marked calcaneovalgus position. There is paralysis of the tibialis posterior and calf muscles and of the flexors of the toes the

posed is found to be thickened and on incising it from the anterior inferior spine of the ilium to the top of the great trochanter an excess of joint fluid exudes which is evidently due to the constant trauma of the joint produced in walking by the recurrent dislocation. The incision in the capsule is continued downward and forward along the anterior intertrochanteric line raising a flap of capsule, including the Y-ligament, the strongest part of the capsule. The head of the femur being now replaced within the acetabulum (Fig 69) this triangular flap of capsule is drawn upward on the superficial surface of the capsule above the head and neck of the femur and is sutured in this position by three mattress sutures of chromic catgut No. 2. The free



Fig. 69.—Capsulorrhaphy for recurrent dislocation of the hip joint. 1. Incision from anterior inferior spine to great trochanter thence along anterior intertrochanteric line. 2. Flap turned down, giving access to acetabulum, for gouging, etc. 3. Posterior view of hip-joint showing method of overlapping capsule by mattress sutures.

edge of the flap is also sutured to the capsule above and slightly behind the femoral neck (Fig 69). The soft parts are closed in layers.

In one boy with recurring posterior dislocation of the shoulder joint, in a case of infantile paralysis, I formed a strong bandlike ligament of fascia lata, fastening one end of it to a tunnel through the base of the spine of the scapula, above and behind the glenoid, and the other end to the greater tuberosity of the humerus. This effectually prevented dislocation, and when seen recently, nearly four months after operation, the stability of the shoulder was good, and its function improving. But in the hip where there is already available so strong a capsule, I believe a free transplant is unnecessary.

fasciæ femoris in the same direction, and identify the anterior border of the gluteus medius whose fibers run parallel with the



Fig. 67.—The left foot at rest showing calcaneus and talar

incision. This muscle is the chief internal rotator of the hip and it is because of paralysis of it or of some of the shorter mus-



Fig. 68.—The left foot, showing extreme calcaneus deformity

cles running from the pelvis to the back of the great trochanter that this recurrent dislocation occurs. The capsule when ex-

in other parts of the country is an original invention of Dr Davis

The operation of horizontal section includes an arthrodesis of the astragalocalcaneal joint and then the tarsus from the anterior extremity of this joint is sectioned horizontally forward until the section emerges on the dorsum of the tarsus in the region of the scaphoid and cuneiform bones beneath the extensor tendons. These, as well as the lateral ligaments of the ankle-joint, must be thoroughly separated from the bones in order that the lower segment of the tarsus comprising the os calcis, cuboid, and lower portions of the scaphoid and cuneiforms may be shoved backward upon the astragalus and leg bones. The peroneal tendons will also be transplanted at the same time into the insertion of the tendon of Achilles, and in this way the valgus will be overcome, the foot will have lateral stability and the heel will project so far backward and the leg bones will come to occupy a place over the apex of the cavus deformity in such a way as to flatten out the cavus deformity and give good leverage to the transplanted peroneal muscles in their efforts to elevate the heel.

(The operation of transverse horizontal section was done on the left foot November 16th. Recovery was uneventful, and the patient was sent to his home November 22d still wearing his gypsum dressings. These will be renewed about six weeks after operation but walking will not be permitted for at least ten or twelve weeks after operation and braces will be worn for several months to furnish support to the feet. It is expected that the braces may be permanently discarded thereafter and that the boy will walk with normal stability even though with a light limp in the left leg which is shorter than the right.)

Next I will do an arthrodesis of the subastragular joint on the right foot. The subastragular joint includes both the astragalocalcaneal joint and the astragaloscaphoid joint. It is the joint in which lateral motion occurs below the ankle. The astragalus is fixed to the os calcis by a strong interosseous ligament dividing the astragalocalcaneal joint into anterior and posterior compartments. The joint is entered by a short incision in front of the external malleolus just above the peroneal tendons, and we gouge the cartilaginous surfaces of the astragalus and os calcis both in front of and behind this interosseous ligament until they are utterly denuded of their cartilage the interosseous ligament is totally destroyed, the object being to convert the astragalus and os calcis into one bone. Sometimes it is possible through this same incision to get an instrument into the astragaloscaphoid joint and similarly to denude the opposing surfaces of the astragalus and scaphoid in order to secure ankylosis there also but as in this patient I wish also to transplant the extensor proprius hallucis into the scaphoid and enable it to work to better advantage in the place of the paralyzed anterior tibial, I will make a separate incision just along the lateral margin of the tendon of the paralyzed *tibialis anticus* and do an arthrodesis through this incision of the astragaloscaphoid joint. Then I draw over the tendon of the extensor proprius hallucis divide it across at the proper level, suture its distal end into the tendon of the extensor communis digitorum and fix its proximal end into a groove cut in the scaphoid at the insertion of the *tibialis anticus*. The soft parts are closed in layers with chromic catgut and a plaster cast is applied from the toes around the pelvis and thorax, fixing the hip in slight abduction and the foot in a position of slight varus.

The operation on the left foot, which will be done, as I say in a week or ten days, will consist in another operation devised by the late Dr G. C. Davis, known as *transverse horizontal section of the tarsus*. I say another operation devised by Dr Davis because I believe that the operation of subastragular arthrodesis, as we know it in Philadelphia and which seems to be unknown

in other parts of the country is an original invention of Dr Davis.

The operation of horizontal section includes an arthrodesis of the astragalocalcaneal joint and then the tarsus from the anterior extremity of this joint is sectioned horizontally forward until the section emerges on the dorsum of the tarsus in the region of the scaphoid and cuneiform bones beneath the extensor tendons. These, as well as the lateral ligaments of the ankle joint, must be thoroughly separated from the bones in order that the lower segment of the tarsus comprising the os calcis, cuboid and lower portions of the scaphoid and cuneiforms may be shoved backward upon the astragalus and leg bones. The peroneal tendons will also be transplanted at the same time into the insertion of the tendon of Achilles, and in this way the valgus will be overcome the foot will have lateral stability and the heel will project so far backward and the leg bones will come to occupy a place over the apex of the cavus deformity in such a way as to flatten out the cavus deformity and give good leverage to the transplanted peroneal muscles in their efforts to elevate the heel.

(The operation of transverse horizontal section was done on the left foot November 16th. Recovery was uneventful, and the patient was sent to his home November 22d, still wearing his gypsum dressings. These will be renewed about six weeks after operation, but walking will not be permitted for at least ten or twelve weeks after operation, and braces will be worn for several months to furnish support to the feet. It is expected that the braces may be permanently discarded thereafter and that the boy will walk with normal stability even though with a slight limp in the left leg, which is shorter than the right.)

Next I will do an arthrodesis of the subastragalar joint on the right foot. The subastragalar joint includes both the astragalocalcaneal joint and the astragaloscaphoid joint. It is the joint in which lateral motion occurs below the ankle. The astragalus is fixed to the os calcis by a strong interosseous ligament dividing the astragalocalcaneal joint into anterior and posterior compartments. The joint is entered by a short incision in front of the external malleolus just above the peroneal tendons, and we gouge the cartilaginous surfaces of the astragalus and os calcis both in front of and behind this interosseous ligament until they are utterly denuded of their cartilage the interosseous ligament is totally destroyed the object being to convert the astragalus and os calcis into one bone. Sometimes it is possible through this same incision to get an instrument into the astragaloscaphoid joint and similarly to denude the opposing surfaces of the astragalus and scaphoid in order to secure ankylosis there also but as in this patient I wish also to transplant the extensor proprius hallucis into the scaphoid and enable it to work to better advantage in the place of the paralyzed anterior tibial, I will make a separate incision just along the lateral margin of the tendon of the paralyzed tibialis anticus and do an arthrodesis through this incision of the astragaloscaphoid joint. Then I draw over the tendon of the extensor proprius hallucis, divide it across at the proper level, suture its distal end into the tendon of the extensor communis digitorum and fix its proximal end into a groove cut in the scaphoid at the insertion of the tibialis anticus. The soft parts are closed in layers with chromic catgut and a plaster cast is applied from the toes around the pelvis and thorax, fixing the hip in slight abduction and the foot in a position of slight varus.

The operation on the left foot, which will be done, as I say in a week or ten days, will consist in another operation devised by the late Dr G. G. Davis, known as *transverse horizontal section of the tarsus*. I say another operation devised by Dr. Davis because I believe that the operation of subastragalar arthrodesis, as we know it in Philadelphia and which seems to be unknown

CYSTIC OVARY

In the next patient we have diagnosed a cystic ovary. She is a young woman, twenty-six years old whose menses began at fifteen years, with five days duration at intervals of thirty days with considerable flow. Her first child was born in 1913 a normal full term delivery the child is now living and well. In 1917 she had a three weeks premature baby and after this pregnancy the patient did not menstruate for ten months, after which time she menstruated every two weeks, the flow being of seven days duration, with considerable pain and a sense of soreness in the pelvis. In March, 1919 she was in this hospital under Dr. Neilson's care and he removed her appendix. The tubes and ovaries were normal at that time, but the patient had a profuse leukorrhea and a smear was positive for the diplococcus of Neisser. She felt better for a while after this operation, but comes back now complaining of pain in the pelvis, a tender mass being palpable on the right side of the midline, evidently the ovary. The perineum is lacerated bilaterally but causes no symptoms. There is no cystocele the cervix presents a bilateral laceration, is soft, and it points toward her left it is freely movable. The fundus of the uterus is anterior freely movable tender and to the right of it under the abdominal wall is this freely movable tense tumor about 3 to 4 cm. in diameter about which she complains. The fundus appears so close to the abdominal wall that if the history of the other operation were not a reliable it would seem that a entrosuspension had been done.

I make an incision 10 cm. long to the left of the median line and opening the peritoneal cavity find no adhesions at all. The appendix site presents no lesions the fundus of the uterus is anterior both ovaries are cirrhotic the left small and atrophic, the right enlarged and as it was the tender one, it is removed the tube being left intact. The uterus is rather larger than

CYSTIC OVARY

In the next patient we have diagnosed a cystic ovary. She is a young woman, twenty-six years old whose menses began at fifteen years, with five days' duration at intervals of thirty days, with considerable flow. Her first child was born in 1913 a normal full term delivery the child is now living and well. In 1917 she had a three weeks premature baby and after this pregnancy the patient did not menstruate for ten months, after which time she menstruated every two weeks the flow being of seven days' duration, with considerable pain and a sense of soreness in the pelvis. In March, 1919 she was in this hospital under Dr. Nelson's care and he removed her appendix. The tubes and ovaries were normal at that time, but the patient had a profuse leukorrhoea and a smear was positive for the diplococcus of Neisser. She felt better for a while after this operation, but comes back now complaining of pain in the pelvis a tender mass being palpable on the right side of the midline, evidently the ovary. The perineum is lacerated bilaterally but causes no symptoms. There is no cystocele the cervix presents a bilateral laceration, is soft, and it points toward her left it is freely movable. The fundus of the uterus is anterior freely movable tender and to the right of it under the abdominal wall is this freely movable, tense tumor about 3 to 4 cm. in diameter about which she complains. The fundus appears so close to the abdominal wall that if the history of the other operation were not available it would seem that a ventrosuspension had been done.

I make an incision 10 cm. long to the left of the median line and opening the peritoneal cavity find no adhesions at all. The appendix site presents no lesions the fundus of the uterus is anterior both ovaries are cirrhotic, the left small and atrophic, the right enlarged and as it was the tender one, it is removed the tube being left intact. The uterus is rather larger than

normal and gives the impression that it is the seat of a chronic metritis, but owing to the patient's youth it will be better not to do hysterectomy until the condition becomes more pronounced, as the uterus may still be capable of functioning. However there is a varicocele in the right broad ligament, and as the round ligaments have slipped from their normal site, allowing sagging of the uterus they will be reattached near the uterine cornua by interrupted chromic catgut sutures. The wound is closed in layers. It is probable that she had a gonococcal infection before her admission to the hospital in 1919 but that this has been largely overcome without involving the tubes. However I expect she will return in the future to this or some other hospital demanding relief for further pelvic complaints.

(The wound healed normally the patient left her bed two weeks after operation, and was discharged from the hospital November 24th being entirely relieved of her symptoms.)

UMBILICAL HERNIA

(OPERATION was done by Dr Irvine M. Boykin.)

This patient, a very stout woman, has had an umbilical hernia for several years. About eighteen months ago she was operated on for gall-stones, and since then her umbilical hernia has continued to enlarge. She has now decided that it is a useless encumbrance and came to the hospital a few days ago with the request for an operation. It is curious how long patients will put up with a certain amount of discomfort rather than interrupt the usual routine of their lives even for a few weeks. Recently a patient who had had an umbilical hernia the size of an orange for seven or eight years noticed while at work that the front of her dress was soaked with blood. She hurried to the hospital and on undressing her Dr Hawfield (the Chief Resident Physician) found the bleeding (which was profuse) came from a varicose vein in the extremely thin skin covering the hernial sac. bleeding was soon checked by pressure with the patient recumbent. It was only this complication which brought the patient to the hospital but when she was once safely in bed in the hospital it did not take very much persuasion to convince her of the desirability of being permanently relieved of her hernia by operation.

INCOMPLETE ABORTION

WHILE my associate, Dr Boykin, is operating on this patient with umbilical hernia, I wish to say a few words to you about the subject of incomplete abortions. You will see that I had a case listed next after the umbilical hernia. We have in this hospital, unfortunately a large number of women who come in with incomplete or threatened abortions, or having just recently had an abortion at their homes. Many of them will acknowledge that the abortion was self-induced and it becomes our duty in this hospital to take care of these patients. The patient whom I had listed for this morning came in three or four days ago and told us that she had had eight children and that when she went two days over her regular period she thrust a slippery elm stick into her uterus because she did not wish to have any more. When a patient such as this is admitted with no history of having an abortion and it is uncertain whether the product of conception is still viable or not, it is of course, our policy to await developments. This patient was bleeding a little. We put her to bed, raised the foot of the bed and hoped that perhaps her attempt at abortion had been unsuccessful, especially as it was uncertain whether she was even pregnant, but she continued to bleed to such an extent that it was evident that abortion was inevitable and yesterday afternoon her condition was evidently not as good as it had been in the morning. Therefore it seemed best to evacuate the uterus at once and not put it off until today. (The tissue from the uterus was reported by our pathologist, Dr C. V. White, as containing placental tissue.)

If the patients give a history of having aborted before admission they are at once anesthetized and with due aseptic care the cervix if necessary is dilated and a blunt placental forceps is introduced cautiously exploring the interior of the uterine

cavity. On my service a curet is never used for these cases, nor is a sharp curet used for any purpose at any time. The tissue that is removed by the curet is invariably sent to the laboratory to be examined and on one or two occasions we have been rewarded for persistence in this routine by having the laboratory report the presence of chorio-epithelioma. Of course, if such a condition as this should be overlooked and a malignant tumor allowed to develop in the uterus, operation of any kind when the patient began to present symptoms would be almost useless. One patient on whom I did a complete panhysterectomy under circumstances of this kind is now free from recurrence and in good health seven years after the operation, although the chorio-epithelioma was well developed at the time of the miscarriage.

There is very great danger of penetrating the uterus in evacuation after abortions and that is the reason why the use of the curet is not countenanced. It is sufficient, as I have said, to introduce a ring-bladed placental forceps, to open it widely and then rotate it by alternately supinating and pronating the hand when the cervix is large enough gauze may be introduced on the finger or over the end of a placental forceps and evacuation secured in this way. I have come to regard it as very important to do this evacuation invariably as soon as the patients are admitted. If one waits there will be a certain proportion of these patients who will develop sepsis, or even septicemia, the latter of which conditions is very nearly fatal and even the sepsis is a complication which it is better to avoid than to relieve.

We have had during the last six months 29 patients of this kind in our ward only 2 of them have run any temperature at all after evacuation, and in both of them it fell to normal within

These may be classified as follows

Incomplete abortions, 21

Uterus evacuated on admission 20 (all recovered)

Death within half hour of admission, 1.

Threatened abortions, 7

Recovered without aborting, 4.

Recovered after aborting, 3.

a few days and the patients recovered uneventfully. In only 1 patient did death occur. This was a woman who had a miscarriage two weeks before admission, had no attention whatever at the time, and was admitted in the last stages of exsanguination and sepsis. She died within half an hour before anything at all could be done to her.

HEMORRHOIDS

THE next patient that I have is a man forty three years old, with hemorrhoids. He has complained of these for the last ten years, and almost always during this time he has had a protrusion of the piles after his bowels moved. Lately the piles come down while he is standing at work, sometimes being extremely painful and bleeding freely. He works as a dyer being constantly on his feet. His bowels have always been fairly regular. He has no shortness of breath, no swelling of the ankles and apart from some cough in the mornings he is in good general health. His lungs and heart are normal, his liver is not enlarged and his abdomen is otherwise negative. So that the hemorrhoids in this case must be attributed to his standing so much at work and not to any cardiac or hepatic condition.

It is convenient when you record an operation for hemorrhoids to identify the various hemorrhoids as if they were on the face of a clock, the uppermost point of the anus when the patient is in the lithotomy position being regarded as 12 noon and the opposite point as 6 o'clock. This man then, we find has five piles located one at 12 noon, one each at 2 5 6 and 9 o'clock. It has been pointed out by Miles that there are three constant sites for piles, two on the patient's right of the anus and one on the left. These piles he terms 'primary'. Secondary piles are not always present and never more than four in number. They develop at other points of the anal circumference. The piles that this man has at the points corresponding to 2 6 and 9 o'clock probably represent what Miles would call the primary piles and the others are secondary piles. In other words, any patient who has more than three primary piles may be regarded as having an advanced case.

The operation that I will do on this patient consists of ligation of the hemorrhoids. First we dilate the anus, introducing the two index fingers side by side, and then by leverage of the

wrists (as is indicated in the accompanying sketch, Fig 70) dilate the anus gradually until the fingers are arrested by the tubercles of the sphincter. Having dilated the anus thoroughly the proctoscope is next introduced and search made in the interior of the rectum for any abnormalities. There appears to be nothing out of the way in this patient. Then each separate pile is



Fig 70 — Digital dilatation of the anus.

grasped in the forceps and drawn well out of the anus (Fig 71). If you grasp only one pile at a time and tie it off before searching for the next pile there is danger that the ligature on the first pile may become displaced during the subsequent manipulations. Therefore it is a rule always to clamp all the piles which are to be ligated at the same time, each with its several clamp

Then with a scissors I snip a groove around the cutaneous margin of each pile passing in a semicircle from the mucocutaneous juncture below the pile to the mucocutaneous juncture above the pile (Fig 72 A) This groove is cut for two purposes In the first place to make a fixed point in which the ligature can be tied and also to diminish the pain after operation, which would

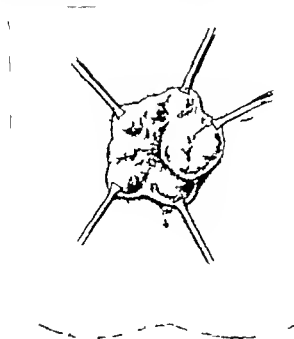


Fig 71 —Each pile is grasped in its proper clamp, and drawn well out of the anal.

be very great if the ligature was tied tight enough to strangle the pile over the intact skin. The groove being cut, a curved round needle armed with a long double ligature of strong linen or silk is passed from the middle of the groove which has just been cut through the base of the pile in the direction of the axis of the anal canal, emerging as high up as possible on the mucous

surface of the anus (Fig 72 *B*) The long double ligature is cut

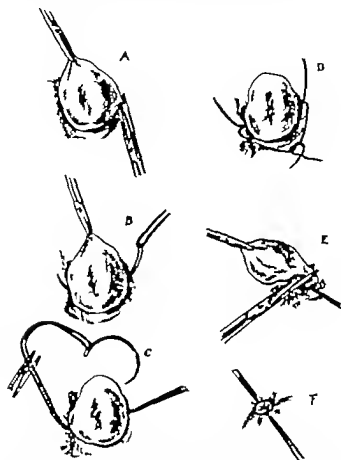


Fig. 72 —Method of ligating hemorrhoid. *A* Groove being cut along the cutaneous border of pile. *B* Needle transfixing pile in long axis of anal canal. *C* The long double ligature is drawn through and divided. *D* The double ligature is tied each side of the pile in the groove previously cut. *E* The pile is cut off. *F* Before cutting the ligature ends snuff the stump of the pile is carefully inspected for bleeding.

near the needle and the two ends are tied tightly one on each side of the pile (Fig 72, *C D*) These ends are left long. Some-

times one of them breaks while it is being tied and it is then convenient to have a second one to double back over the first half of the pile after it has ligated the second half. Then while these ligatures are held taut by an assistant the operator cuts off the pile which protrudes beyond the ligature and carefully inspects the base of the pile for bleeding. Before the ligatures are cut short tension is relaxed and the pile allowed to retract, and again bleeding is looked for. The same process is repeated with each separate pile taking care always to pass the needle which transfixes the pile in the long axis of the canal and paying particular attention to securing complete hemostasis. Now you may think that it is very unnecessary to take so much trouble over a simple operation like that for hemorrhoids, but it is because it is such a simple operation that it is unusually worth while taking trouble to make sure that nothing goes wrong. I was taught to do it in this way and I had always been taught that there was danger of hemorrhage. I never saw any hemorrhage occur until one time about a year ago when in the middle of the night a doctor who had operated upon a patient for hemorrhoids in the patient's house called me up and said that ever since the patient recovered from the anesthetic in the afternoon he had been passing clots from the bowel, sometimes as much as a pint at a time, and he said that the patient was evidently bleeding freely and he wished me to help him out. The patient was sent in to the hospital, anesthetized, and an intravenous injection of saline was given and when I passed my finger into the anus large quantities of clotted blood and some fresh blood squirted out. The patient was very pale, his hemoglobin was 70 per cent. and his red blood-cells numbered only 3,070,000 and he was very nearly dead from his hemorrhage and the reason for it was that this doctor operating in the patient's house (I suppose with not a very good light) had not taken the precaution to

Findings such as these within a few hours of the onset of hemorrhage indicate very severe degrees of anemia. The red blood-cell count always shows more prompt response to hemorrhage than does the percentage of hemoglobin. It was pointed out by Depage, early during the German War that if the red blood-cell count fell below 4,000,000 within six hours of the injury exceedingly few patients would recover. About transfusion of blood.

make sure that his ligatures were placed sufficiently tight to check all bleeding. He did not cut any groove around the skin margins of the hemorrhoids and either at the time of operation or very soon afterward at least one of his ligatures had slipped and hemorrhage into the rectum began and only gave evidence of its pressure when the rectum became so full that the patient had to expel some of the clots. It was several days before this patient was entirely out of danger. So you see that the operation for hemorrhoids may be attended by complications unless it is done with great attention to detail, and that is the reason why I am trying to impress upon you today the importance of accuracy and care in the operation.

The operation by clamp and cautery I scarcely ever use merely because I feel it is safer to have a ligature around the base of the hemorrhoid than to trust to the clot produced by the cautery. No suppository or any other local application except a dusting-powder to the surface of the pile is applied. A perineal pad is held in place by a T-bandage, and on the fourth day if the bowels have not moved sooner a dose of castor oil is given and the patient is kept in bed for from seven to ten days. Here again I know that many surgeons get these patients out of bed within a very short time, but I am convinced that patients with hemorrhoids as well as patients with many other comparatively slight operations do better if kept at rest until reparative processes are really well advanced.

CELLULITIS OF FOREARM AND THIGH

THE last patient that I have for operation today is a baby six months of age, with suppurative cellulitis of the right fore arm and hand and of the right thigh. The baby was admitted to the hospital two days ago. His mother died four months ago "from a stroke." It is said that she went insane after the birth of the baby and was sent to the Philadelphia General Hospital. As a consequence the baby did not get proper attention, but was taken to the Lankenau Hospital and was bottle fed there until September 21st. During the past week the baby's caretaker noticed that the fingers of the right hand were beginning to swell and then this swelling extended up the hand and forearm and redness appeared. She also noted that there were several sore places in the right groin. The baby's temperature on admission was $104\frac{1}{2}$ ° F. Its pulse 140 its respirations 36 and it was very ill. The right index-finger and flexor surface of the wrist were red, hot, and swollen. In the right groin there was a furuncle with an area of redness and induration the size of the palm of the hand. In the right iliac region was a sore resembling a chancre. It is possible that the child has congenital syphilis in addition to its acute infection. The history of the mother having died from a stroke and being insane although nothing else is known about the family history is not inconsistent with the presence of syphilis in herself.

Yesterday the dorsum of the hand was incised by the ward resident and the child's temperature fell to $99\frac{1}{2}$ ° F. but rose again to $102\frac{1}{2}$ ° F. Today I want to open the hand further and also the forearm and the thigh. I will give the child no anesthetic since it can be barely conscious of the pain until after the cut is made when it will have no recollection of the previous momentary pain. Very small infants have neither anticipation of suffering to come nor recollection of that which is past and when the constitutional condition demands it, one is quite

justified in producing momentary pain. The forearm as you see, on the flexor surface is tense and swollen, and I will make the first incision over the radial surface above the wrist, and here I find some purulent fluid (The culture was subsequently reported as containing staphylococci.) The second incision I make over the ulna above the wrist opening the pronator space, I find here no pus, but will leave in a drain of rubber tissue, as it is not unlikely if the child survives that pus will eventually be found in this neighborhood. The third incision I make on the dorsum of the hand over the index metacarpal, finding only necrotic subcutaneous tissue. You will see that I made my first incision where I was least apt to find advanced infection so as not to spread infection from the more infected to the less infected zones. In the thigh I make a crucial incision over the furuncle below Poupart's ligament, finding pus and necrotic fat. A moist dressing of 2 per cent. sodium citrate solution is applied to both areas of infection, a splint being placed on the forearm in order to enable us to maintain it in vertical suspension. By cutting little nicks each side of the splint where it protrudes beyond the hand and tying a bandage tightly around the splint through these nicks the splint and, therefore, the forearm can be hung up in vertical suspension. This is a valuable method in all cases of cellulitis, and it is surprising with what rapidity the swelling will go down under these circumstances.

The baby was somewhat improved for few day after operation. It took its nourishment better its temperature gradually reached the normal, and had been normal ten days before his death on November 10th, five day after operation. An autopsy as held which showed metastatic abscesses in both lungs, in the kidneys, and in the spleen. Cultures from these abscesses gave growth of *Staphylococcus aureus*. The postmortem blood Wassermann was negative. (Drs. C. Y. White and A. A. Walling.)

OPEN REDUCTION OF FRACTURE OF THE FOREARM (DRESSING)

Now we have a fracture of the forearm to dress one which in many ways resembles the fracture of the tibia on which I operated this morning. This boy who is thirteen years old on whom I operated October 27th, was admitted to the hospital on October 19th. He slipped and fell with the left arm doubled up under him. He walked to the hospital and received treatment within an hour of injury. There was fracture of both bones of the forearm compound of the ulna, and its upper fragment was projecting slightly through the skin on the ulnar surface of the forearm. It was evident that there was a fracture of both bones about their middle and there seemed to be some overriding. An x-ray showed that there was, in addition a second fracture of the radius a little above the wrist joint, and that while the other fracture of the radius and that of the ulna were in fair position yet the lower fracture of the radius had the fractured surfaces not in contact at all (Fig 73). The patient was first redressed on October 23d four days after the accident, and it was determined that it would be necessary to secure reduction of the lower fracture of the radius by open incision.

Therefore the preparation for the operation was begun on October 25th and the operation was done on the 27th. Today I am going to do the first dressing since the operation, now ten days ago. He was dressed on a posterior splint made of plaster of Paris and on a right-angled splint fixing the elbow with the forearm in full supination. As you will see, the x rays made since operation (Fig 74) show that while reduction of the lower fracture of the radius was secured yet that in securing that reduction the upper fracture of the radius became disarranged but that does not worry me very much because a fracture such as this was, far from either the elbow or the wrist and particularly in so young a patient, will almost invariably give a good result even

if it is not accurately reduced. Moreover the upper fracture of the radius and the fracture of the ulna are not at the same level, and there is, therefore, very little danger of one fracture interfering with the other. If they are both precisely at the same level it sometimes happens that the lower fragment of the ulna will unite with the upper fragment of the radius or vice versa, but, as I saw where the fractures are not at the same level such an occurrence could hardly take place.



Fig. 73.—Double fracture of radius and compound fracture of ulna, in boy thirteen years of age. Note that middle fragment of radius is not in contact with either upper or lower fragment.

The splints have now been removed and I will raise the gauze covering the incision. You will see that it is entirely dry although blood stained except at one point, where it is a little moist. I should rather see the gauze entirely dried up, and as I draw this last layer of gauze away from the wound there appears to be one drop of pus between two of the sutures. We will take a culture of this, but I do not believe there will be any growth from it, for the boy has had no fever whatever since the

operation, and there is not the least bit of induration or redness or swelling about the incision. (As a matter of fact, no growth could be obtained from this culture and at the second dressing the wound was entirely healed.)

The fracture will be redressed on an anterior and posterior splint, and after the second dressing when I make certain that the soft parts have thoroughly healed the boy will be discharged and referred to the dispensary for after treatment.



Fig. 74—Fractures shown in Fig. 73, after open reduction of lower fracture of radius—good union in all the fractures, though the upper radial fracture is not in good alignment.

(The second dressing was made November 13th, the wound was found entirely healed and the boy was discharged.)

In this case the displacement of the fragments of the radius above the wrist was so marked that there was a suspicion that the median nerve was compressed. Immediately after the injury there was some hyperesthesia in the distribution of this nerve and the swelling of the hand was so great that for the first week

after the accident he was unable, or unwilling to move his fingers at all. At present, ten days after the operation there is free motion in all the fingers, the swelling has entirely disappeared and when he has the splints off he can begin to oppose his thumb to his index and middle fingers.

I have also 2 cases to show you which I think are of interest from the standpoint of diagnosis.

Splint was discontinued seven weeks after operation. Function of the hand was perfect, and there was rotation of the forearm from the position of full supination to that of midpronation. This rapidly increased.

TWO CASES OF EFFUSION INTO BOTH KNEES: ONE SYPHILITIC, THE OTHER HEMOPHILIAC

WHEN I took the Children's Ward under my service on November 1st this year I found in the ward a boy five years old who was thought by my predecessor to have tuberculosis in the right knee. The boy is known to be a hemophiliac. His mother and father are living and well and there is no history of hemophilia in the family except that one brother was said to have been a bleeder and died at the age of ten months with bleeding from the gums. He has one sister living and well, three years old. This boy was admitted to the hospital September 24th under Dr. Denver's care, and the history taken then says that his general health had been fairly good he had had whooping-cough two months previously and his nose bleeds, it is said, very often in fact, nearly every time he cries. Two weeks before his admission to the hospital he had a lacerated wound of his cheek, but there is no history of his having bled unduly at that time. However he was in this hospital somewhat over a year ago with persistent bleeding following a scratch on the finger. This bleeding continued for seventeen days after his entrance, and the record says that his hemoglobin fell to 20 per cent. His chief complaint on admission this year was pain in the right knee joint. This began thirteen months previously and followed a sprain of the knee. He was in another hospital for six weeks at first, but the knee even after his discharge from that hospital continued swollen and tender and pained him, especially at night.

He is a poorly nourished, sallow complexioned boy and the physical examination is negative except for the knees. The right knee is markedly swollen and on admission was tender. The overlying tissues at that time were hot to the touch there was fluctuation in the joint and it was kept semiflexed. He was treated with extension to the knee and considerable improve-

ment had occurred before the boy was transferred to my service on the first of this month. I found that there was effusion also in the left knee (Fig 75). The circumference of the right knee was 25 cm. and of the left 23 cm. The right knee could be flexed only to 90 degrees, whereas the left knee flexed to 40 degrees the patella floats in both knees.

x-Rays had been made and they are negative for bone changes. Now it seemed to me that if this boy had had a tuberculous process in his knee for fifteen months thirteen months before admission to the hospital and two months after his admission, surely by that time there should be some visible



Fig 75.—Effusion into both knees in boy with hemophilia

roentgenographic evidence of bone lesion. So that, although I am not very certain of the diagnosis, I was inclined at first to believe that the boy had hemorrhage into the knee-joints. Over the left anterior superior spine you see there is an ecchymosis about 2 x 3 cm. in diameter there is general glandular enlargement in the neck, in the groin, and slight enlargement of the epitrochlear lymph-nodes on both sides. There are carious molar teeth on each side of the mandible, the tonsils are hypertrophic, the left nostril contains clotted blood and on the right cheek are two scars from the lacerated wound noted above. Several times recently there has been some blood passed by the bowel.

I have asked several other members of the staff to see this boy. Dr. Fussell asked for a complete blood-count, and the blood chemistry especially the calcium content of the blood. Dr. Robertson thought that the general adenopathy indicated a tuberculous condition. Dr. C. Y. White thought it would be interesting to study the corpuscles of the blood, to investigate the chemistry of the blood especially the fibrin content and also to make a general chemical study of the patient's intake and output.

The trouble with all these requests, except the last, is that they involve the danger of bleeding and I am not inclined to run that risk unless I could be convinced that something of a therapeutic nature could be done for the boy after the tests had been made. I asked Dr. Alonzo E. Taylor the other day about hemophilia and he told me that physiologic chemistry could do nothing for such cases that the fault was a biologic one and that it was necessary to treat the parents or grandparents of the patients but when I told him that the patient that I had under my care at present might some day be a parent or a grandparent and there was now an opportunity for him to begin treatment three or four generations in advance—even then he could think of nothing that would do the boy any good. He tells me that in Serbia he saw many cases of peri-articular hemorrhage from scurvy but the effusion in this patient certainly is within the joint. I propose to put the boy's knees in plaster of Paris so as to immobilize them thoroughly and to adopt Dr. Robertson's advice of giving him 15 minims of hydrochloric acid in milk three times a day in an effort to increase the calcium content of the blood.

I should add also that the diagnosis of tuberculosis is not supported by x-ray examination of the chest which is negative. It may be a case of congenital syphilis but I do not like to run the risk of drawing blood for a Wassermann test. The boy however has just begun a course of iodids.

The second boy with effusion into both knees is ten years old and was admitted to the hospital day before yesterday (Fig. 76)

As soon as I saw that he had effusion into both knees I thought of

congenital syphilis, and when I noticed also the condition of his left eye I was positive of my diagnosis (Fig. 77). Then I inquired into his family history. His father died of lung trouble, his mother of pneumonia. Eight other children died at ages varying from seven to twenty-one years: there were some miscarriages, and only two brothers are living and well: the elder who is the firstborn child and now twenty-seven years of age, tells me he was himself a premature baby and he is stunted in appearance, presents a saddle-nose, and facial characteristics of inherited



Fig. 76.—Effusion into both knees in case of hereditary syphilis

syphilis in a mild degree. The other living child, now thirteen years of age, has sore eyes and running ears, and is under treatment for these conditions in another hospital. Our patient was the last born child and his eldest brother tells me, was the huskiest of the family. He has had measles and chicken pox, but his general health has always been good. The condition of his left eye, according to his brother, developed when he was about two years old, but no attention seems to have been paid to it.

His chief complaint was a swollen knee-joint (the left) of which he first started to make complaints about two weeks before admission. The knee was slightly tender but he could walk. There is no history of hemophilia or of injury. The blood Wassermann is +3. Dr. Goldberg examined his eyes and reported that in the left there is moderate ptosis, that the eyeball cannot be raised above the median plane, that there is a definite



Fig. —Ptosis of paralytic of extra-ocular muscles, from a nuclear lesion in case of hereditary syphilis.

paralysis of the superior rectus and the superior oblique muscles from a nuclear lesion. The eyes are never upon the same plane. There is great difficulty in converging especially in covering the two eyes at the same time. The pupils are regular and equal and react to light and accommodation.

Now you will notice that the boy's mouth is also rather characteristic of congenital syphilis. There are rhagades in the

congenital syphilis, and when I noticed also the condition of his left eye I was positive of my diagnosis (Fig. 77). Then I inquired into his family history. His father died of lung trouble, his mother of pneumonia. Eight other children died at ages varying from seven to twenty-one years, there were some miscarriages, and only two brothers are living and well—the elder who is the firstborn child, and now twenty-seven years of age, tells me he was himself a premature baby and he is stunted in appearance, presents a saddle-nose, and facial characteristics of inherited



Fig. 76—Effusion into both knees in case of hereditary syphilis

syphilis in a mild degree. The other living child, now thirteen years of age, has 'sore eyes and running ears, and is under treatment for these conditions in another hospital. Our patient was the last born child and his eldest brother tells me, was the huskiest of the family. He has had measles and chicken-pox but his general health has always been good. The condition of his left eye, according to his brother developed when he was about two years old but no attention seems to have been paid to it.

His chief complaint was a swollen knee joint (the left) of which he first started to make complaints about two weeks before admission. The knee was slightly tender but he could walk. There is no history of hemophilia or of injury. The blood Wassermann is +3. Dr Goldberg examined his eyes and reported that in the left there is moderate ptosis, that the eyeball cannot be raised above the median plane—that there is a definite



Fig. 77—Ptosis and paralysis of extra-ocular muscles, from ocular lesion in case of hereditary syphilis

paralysis of the superior rectus and the superior oblique muscles from a nuclear lesion. The eyes are never upon the same plane. There is great difficulty in converging especially in converging the two eyes at the same time. The pupils are regular and equal and react to light and accommodation.

Now you will notice that the boy's mouth is also rather characteristic of congenital syphilis. There are rhagades in the

midline of the upper lip. His posterior cervical and epitrochlear glands as well as those in the groin are palpable, but the axillary lymph-nodes I am not certain about. There is effusion in both knees and the patella flotta. The left appears larger but measurement shows that the circumference of each is 29 cm. They cannot be quite fully extended the right can be flexed to 30 degrees and the left to 25 degrees.

Many of these cases of syphilitic knees are mistaken for and are treated for tuberculosis, but almost invariably the pain is not as great as in tuberculous disease the lesions appear to be confined largely to the synovial structures, x ray examination as in the present patient showing no lesion of consequence, at the most a little roughening of the under surface of the patella and of the internal condyle of the femur and then the fact that usually multiple joints are involved in congenital syphilis is another diagnostic point of importance. Of course, to confirm this we have the family history other syphilitic lesions in the same patient, and the Wassermann test. Constitutional treatment usually is all that is required to bring about rapid relief. If the joints are painful or if there is much effusion, as in this case, they should be put at absolute rest by being encased in plaster-of-Paris cases, but operative treatment is rarely if ever required.

(Improvement in both these patients was rapid and continuous both boys became rosy and fat and happy the hemophilic's knees soon ceased to pain, and he walked all around the ward with his crutch on while the syphilitic knees likewise showed progressive improvement, as did his ptosis and extra-ocular palsies.)

CLINIC OF DR. JOHN H GIBBON

PENNSYLVANIA HOSPITAL

AMPUTATION OF THE BREAST FOR CARCINOMA; THE STEWART INCISION

Preliminary Considerations.—Before undertaking any operation for cancer of the breast it is important to determine that the case is a proper one for operation contraindications as well as indications should be considered. Many cases of cancer of the breast which at first sight might seem to offer a good prospect of cure are really inoperable because the disease is too far advanced or because metastasis has already taken place. The insidious metastases to the spine and the mediastinum especially in scirrhous carcinoma, should always be borne in mind. I have seen more than one case of this kind in which the patient sought relief for the spinal pain before she was conscious of the growth in the breast, and many more where a few weeks or months after the radical operation a spinal or intrathoracic metastasis manifested itself. A dry chronic cough, shortness of breath on slight exertion, or a persistent soreness and stiffness in the back which does not respond to the ordinary remedies for "lumbago" should make one hesitate to undertake a radical operation for cancer of the breast. Such a case should receive a painstaking physical examination and x-ray study. It is an old observation that the removal of the primary cancer causes more rapid growth in a coexisting metastasis and my own clinical experience tends to confirm it. An amputation of the breast in the case of inoperable cancer does the patient no good but does do surgery harm for it confirms the wide-spread belief in the laity that surgery cannot cure cancer. This mistake brings even wider spread bad re-

sults, because other patients, observing the uselessness and futility of the operation, avoid it themselves, and turn to other ineffectual means of treatment during the operable period of their own disease. In other words, we are educating the public wrongly. *How much better to say frankly that the patient has presented herself too late for operation.* The effect upon her acquaintances afflicted in like manner is obvious, and in my opinion this is the right way to instruct the public. It is the duty of every physician to teach the public that surgery does cure a large percentage of cancers, especially of the breast, if it is early and radical surgery.

Do not be content to become skilful operators, but develop surgical judgment which will enable you to avoid surgical blunders. Tumors of the breast deserve just as careful study just as careful physical examination, and the exercise of just as good surgical judgment as the diseases of the upper abdomen. It should be just as chagrining to the surgeon to remove a breast for cancer in the presence of a determinable metastasis in the spine or mediastinum as to remove a "chronic appendix" in the presence of a duodenal ulcer or a stone in the ureter. Each shows a lamentable lack of care and an exhibition of no surgical judgment.

The Patient.—The case to be operated upon this morning is that of a woman sixty five years of age, in excellent health except for a small, hard, fixed tumor in the breast. The tumor was first noticed only four weeks ago but it has existed undoubtedly for a much longer period of time. It is a scirrhus carcinoma which easily escapes the observation of the patient because it does not, as a rule, make a swelling which the patient can see or easily feel. Sometimes these growths are not discovered until the patient finds "lump" in the axilla, a glandular metastasis, which is often larger than the primary growth. In the present case no glands can be palpated in the axilla, but one can be assured that glandular involvement will be found in the shape of small hard glands, many no larger than grains of wheat. A careful examination has revealed nothing to make one suspect the possibility of metastasis elsewhere. It cannot

be too often repeated that glandular enlargement is not a symptom of cancer but one of its sequelae.

The Operation.—The incision constitutes a very important part of any operation and deserves careful planning. A badly placed incision hampers the operator in the subsequent steps of the operation, may necessitate the making of a second incision or result in unnecessary disfigurement of the patient. In order to appreciate this one has but to consider an incision for inguinal hernia placed too high or too low a vertical instead of a transverse semilunar incision in fracture of the patella, and incisions across the normal creases of the neck instead of in their floor. Probably the worst feature of a badly placed incision is that it does not give ready access to the tissues and structures to be dealt with later. A faulty incision is the most common mistake made by the beginner in surgery and when made, is sure to lead to other and often more serious ones. The ideal incision is one which permits the best access to the structures to be dealt with which does the least damage to the tissues through which it goes, which can be closed with the least disfigurement, and which results in the least disturbance of the normal relations and functions. Probably the most important desideratum is the first mentioned certainly in dealing with malignant disease, but the others deserve consideration at all times. What, for instance, is the use of making a central incision for the removal of a thyroglossal cyst, an incision which will later give a wide and ugly scar when just as good an exposure and practically no disfigurement can be had from a transverse incision?

Probably more incisions have been employed in amputation of the breast than in any operation in surgery. Up to the time when Francis T. Stewart described his incision before the American Surgical Association at Rochester Minn., in 1915 (*Annals of Surgery* Vol. 62 p. 252) the incisions which gave the best cosmetic results and interfered the least with subsequent function were the worst, because they did not include enough skin or did not give sufficient access to the tissues to be removed. Up to this time all the incisions which gave the best access and

best enabled the surgeon to deal with the disease resulted in disfigurement and often disability. One might say that this should not be objected to in view of the fact that they were the result of the thorough removal of a malignant growth of the breast, but nevertheless, such incisions were not ideal. As it is my intention to lay particular stress today on the Stewart incision for amputation of the breast, nothing further will be said of any other except that in many of them too little skin is removed, in most of them there is too much subsequent disfigurement and in some a resultant loss of function due to the scar which extends from the chest to the arm.



Fig. 78.—Outline of incision, showing extent of skin removed

The incision of Stewart might be called the elliptic transverse incision, the ellipse including as much skin as is indicated. The exact situation of this elliptic incision may vary with the site and size of the tumor that is to be removed. It should be placed higher when the tumor is near the upper periphery of the gland or lower when the tumor is near the lower periphery. This shifting of the lines of incision permits one to remove the skin above or below the breast as the situation of the tumor may indicate. A glance at the outline of the incision as shown in Fig. 78 would cause one to doubt the possibility of being later able thoroughly to expose the axillary structures. I can only say that I have employed this incision in 91 cases and have felt

that I obtained as good an exposure of the axillary structures as with any other incision. The other figures indicate the exposure which is obtained by thoroughly mobilizing and retracting the skin over the pectoral muscle and in the axilla. These drawings were made at the time of operation and represent its different stages. When the elliptic incision through the skin has been made the skin should be thoroughly mobilized both above and below the gland. The mobilization above should extend down the arm beyond the hair-line of the axilla.

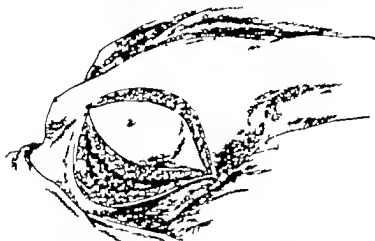


Fig. 79.—Mobilization of lower skin-flap, which facilitates closure of wound and the wide removal of fat and fascia with the breast.

One of the advantages to be gained from doing this mobilization at the beginning of the operation is that it permits one to remove more of the fat and fascia beyond the breast. With the mobilization and retraction of the axillary skin it will be seen that the pectoralis major tendon is exposed down to the point of its insertion.

The next step in the operation is to determine what structures are to be removed. It is my own custom in practically all cases to remove both pectoral muscles and a part of the sheaths of the latissimus dorsi and serratus magnus muscles. I

think, however that it is a bad plan to follow too routine a procedure, because if the growth is situated at the lower and inner quadrant of the breast I believe that it is much more important to remove the fat and fascia from the upper portion of the rectus than it is to remove the lesser pectoral muscle. The greatest advantage to be derived from the removal of the lesser pectoral is that the division of its tendon gives a much freer exposure of the glands along the axillary vessels and per

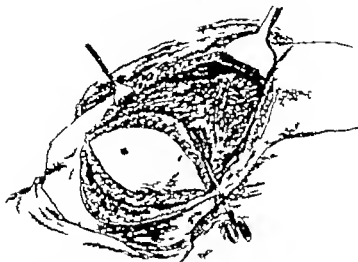


Fig. 80.—Mobilization and retraction of upper skin flap. The pectoral portion of the pectoralis major has been separated from the clavicular portion and its tendon divided near its insertion.

mits their more thorough removal. In this case we will first separate the clavicular from the pectoral portion of the pectoralis major and then divide the pectoral portion of the tendon near its insertion into the humerus. This portion of the muscle is then reflected, the tendon of the lesser pectoral isolated, and divided near the coracoid process. The glands and the fat of the axilla are then separated from the vessels and reflected with the muscles. At this time the posterior axilla is given careful attention, all the fat overlying the subscapularis muscle and

the *latissimus dorsi* is removed and if the glandular involvement is marked, a portion of the sheaths of these muscles. The origin of the pectoral muscles is then divided, but not too close to the ribs, as too close division makes the control of the bleeding more difficult. The breast, with the attached muscles, glands and fat, and fascia are then turned downward and as much of the sheaths of the rectus and the serratus muscles is removed as is indicated by the extent and situation of the

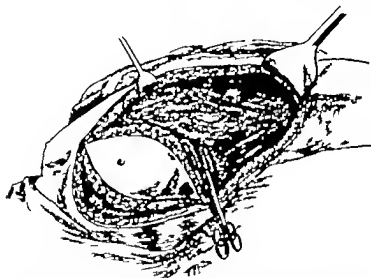


Fig. 81.—The possible retraction of the upper flap and the division of the tendon of the *pectoralis minor*. The extent of the exposure of the axilla is indicated by the stump of the tendon.

growth. Although it is desirable to remove all the glands and fat with the breast and muscles, one should always go back to the axilla and make sure that none of these tissues have been left. It has not been my custom to remove the supraclavicular glands as a routine except where they are palpably involved or where the growth is situated near the upper periphery of the breast. If the supraclavicular glands are palpably involved my feeling is that we are dealing with a pretty far advanced disease,

If not one that is inoperable and in any such case I think that good x-ray plates should be made of the chest in order to eliminate as far as possible the question of intrathoracic involvement.

Before closure of the wound hemostasis should be absolute, because one of the most troublesome things after this operation is the accumulation of blood or blood-serum under the flaps. In order to obviate this, in addition to complete hemostasis, a small rubber-covered drain is placed in the axilla and allowed

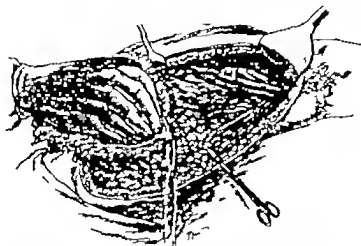


Fig. 82—The final step of the operation. After the reflection of the axillary glands and fat, with as much of the sheaths of the subscapularis, the latissimus dorsi, and serratus muscles as is indicated, the attachment of the pectoralis major and minor is divided.

to escape near the outer angle of the wound between two of the stitches, a loop of a silkworm-gut stitch being passed through the drain in order to prevent its slipping out or in. This drain is usually removed at the end of twenty-four hours unless there is an escape of considerable serum when it is left in for another twenty-four hours. The drain should never be replaced, as continued drainage is very apt to result in infection. If serum continues to accumulate it is better to evacuate it once a day by separating the edges of the wound at the site of the drain.

The skin about this opening should be painted with iodin at each dressing to prevent infection from the skin.

One of the serious objections, certainly from the patient's point of view to many of the incisions employed for amputation of the breast is that the wound cannot be completely closed and that immediate or subsequent skin-grafting is necessary. With the Stewart incision, in more than 90 cases with ample excision of the skin, I have only had to resort to grafting in 2 or 3 cases. In closing this elliptic incision you will observe that the wound is closed from the two ends, that is, one stitch is



Fig. 83.—The closed wound with small rubber-covered drape. Auxiliary skin forced back into position, which is easily done when the elbow is raised from the table and the arm is at right angles to the body.

placed at one end and then at the other because if the closure is started at one end and carried regularly across the wound one is very apt to find that a slight difference in the length of the two lines of the ellipse will result in a disfiguring inequality in the two edges of the wound. This inequality in the length of the two incisions making the ellipse is often necessary because of the situation of the tumor and the desire to remove the skin widely about it. It can usually be accounted for in closing the wound by including a little more tissue between the stitches on the long side. You will observe that this wound when closed makes a practically straight line across the chest. Before apply

ing the bandage the elbow is elevated and the arm placed at right angles to the body when it will be possible to force the mobilized skin of the axilla well up and hold it there without difficulty with a gauze dressing. A circular bandage of gauze or a binder is put about the chest and the arm left perfectly free. The patient is encouraged to move the arm and it is moved for her many times a day. It is a mistake to bind the



Fig. 84.—Patient has, unaided, placed her hand on the head ten days after operation.

arm to the side, as it greatly increases the patient's postoperative discomfort, and may result in adhesions which interfere with the subsequent full elevation of the arm. If the arm is not bound to the side, but kept usually at a right angle to the body and the patient encouraged to move it, she can at the end of two weeks put the arm through its normal range of motion. You will observe that the scar of this incision is so placed that a woman is able to wear a modest low neck dress without the

loss of the breast being suspected or without any part of the scar being visible.

Results.—The immediate results in cancer of the breast are very satisfactory and due to the thorough operation that is now usually done local recurrences are much rarer than formerly when too little skin was removed but too large a proportion of these patients later develop bony or visceral metastases, especially the cases of scirrhous carcinoma. I think one must honestly say that it is impossible to tell when a patient is cured of cancer. I have seen 2 recent cases of recurrence five and a half and six years after the amputation of the breast, and some years ago had a recurrence seven years after the resection of the colon for cancer. These are exceptions, of course. The patient who goes five years after operation with no evidence of recurrence may be considered cured.

I am quite sure that my own results are 25 per cent. better during the past ten years, and I attribute it not to any improvement in the technic, but to the routine use of the x-rays after the operation. I am sure that the x rays, too, have much to do with reducing the percentage of local recurrences. I think most surgeons now have come to feel that except in very advanced cancers of the breast local recurrences are not to be expected.



CLINIC OF DR. CHARLES F. NASSAU

JEFFERSON HOSPITAL

EPITHELIOMA OF THE LIP

EPITHELIOMA of the lip is the most common malignant growth occurring on the face and causes more than 2 per cent. of all deaths from cancer. It is from 17 to 19 times more frequent on the lower lip than on the upper. Lohs, in a study of 534 cases, found the proportion 1 : 17. Fricke 1 : 19. Broders 1 : 26.

A striking fact in epithelioma of the lip is the preponderance of its occurrence in the male sex. The relative frequency of epithelioma of the lip in the male and female according to Broders, is 49 : 1. The examination of Continental statistics shows a somewhat higher percentage of epithelioma of the lip in the female, the percentage of its occurrence ranging between 7 and 12 per cent.

There is a wide range of variation in the ages during which epithelioma of the lip develops. A number of cases have been reported in patients twenty-one and twenty-two years of age. It is well to remember however that congenital blemishes (nevi, moles, lymphangiomas, epidermoidal rests, adenoma of the mucous glands of the lips, etc.) are prone to occur in association with which histologic appearances may be met with (ingrowths, pearls, etc.) similar to those seen in epidermoidal cancers and in some ulcerative processes due to the tubercle bacillus and syphilis somewhat similar appearances may be met with.

A review of almost 3000 cases, as reported by various authorities in the literature discloses that the average of its occurrence is between the years of fifty five and sixty more than one half of the reported cases develop between the fifth

and seventh decades of life, and 95 per cent. of cases occur in patients past middle life.

A family history of malignancy plays a negligible part in its etiology. The disease occurs most often in farmers and other outdoor or partly outdoor occupations. 15 to 20 per cent. of the cases are found among those engaging in various indoor occupations. It would seem that outdoor life acts in some unknown manner upon a lesion which originally caused a break of the cutaneous epithelium. A common antecedent history is the presence of a cracked, fissured, or chapped lip which does not heal. There is similarly a frequent history of a slight trauma which produced a cutaneous epithelial abrasion, for example, the irritation of a jagged tooth. Furthermore, in a number of cases, the occupation of the affected individual was that of a flute player and bugler. The important factors in its genesis are the presence of some lesion or trauma producing a loss of the epithelial covering and a second factor of some form of chronic irritation.

Palme, director of Cancer Hospital Research Institute, London, is of the opinion that cancer is not a specific disease due to activities of a special parasite, but is a disordered growth of epithelium caused by various chemical or physical irritants, the most important being the toxins of micro-organisms. He considers that the origin of cancer lies in the degeneration of the nobler parts of the cell, consequent on damage of its structure. The result of this damage is to disturb the balance of metabolism by impairing that special function of the cell, thereby causing persistent overgrowth.

The relation of the use and non-use of tobacco to the development of epithelioma of the lip opens up a most interesting study. The high incidence of epithelioma of the lip in farmers has been attributed to their habit of pipe smoking, the latter acting both as a mechanical and chemical irritant, the former by pressure of the pipe, the latter through the heat and combustion products engendered. Yet the history of many cases fails to give a conclusive answer. The percentage of the occurrence of epithelioma of the lip among smokers and non-smokers shows relatively

little difference. The latter fact is borne out by statistical studies of Broders, Loos, Werner, Reguhal, Fricke, and others.

It is well to state that carcinoma of other parts of the face affects most commonly the male, *e. g.* carcinoma of the ear shows a preponderance of occurrence in the male in proportions varying from 7 : 2 to 15 : 1 according to different authorities (Trendelenburg, 15 : 1; Gueld, 12 : 1; Loos, 7 : 2; Wintharper, 6 : 1).

Epithelioma of the lip is often preceded by some lesion which has produced a break in the protective epithellum, *e. g.* an abrasion, cold sore, crack in the lip, patch of leukoplakia, scorbutic patch, chronic fissure, blister or a small warty growth. Later induration and thickening begin to develop and sooner or later an ulcer forms. After the ulcer forms it may spread rather rapidly until a greater or less part of the lip is involved. As the ulcer spreads it eats and destroys the lip, the covering of the chin may involve the mandible in the process, and not infrequently forms a large foul ulcerating mass, involving the lip, floor of the mouth, lymph-nodes, and even the mandible. Death occurs from pain and exhaustion or from hemorrhage. The disease, if not operated upon, lasts from commencement to end from two to five years. If the jaw is involved the prognosis is bad and it is practically hopeless if the floor of the mouth is involved.

As in the tongue, these precancerous conditions are recognizable and well defined. The importance of their early recognition and treatment cannot be overestimated for it is these innocent lesions that frequently undergo carcinomatous changes. I am firmly of the opinion that the above precancerous lesions, if they do not respond to mild treatment, should be treated as malignant growths. In this stage they are amenable to treatment and offer a most favorable prognosis. It is the destruction of the epithellum that appears to afford a portal of entry for malignant degeneration.

The reason for early and active surgical intervention in these conditions is all the more urgent since the stage of transition into active malignancy is not easily recognizable by clinical signs.

Induration about the edge and base of the ulcer is of sinister significance. The lowered resistance especially by previous syphilis, may be an active agent in its development. In the earliest precancerous stages the lesion is local.

Bloodgood states that a wart on the lower lip larger than the end of the index-finger was always microscopically malignant, but smaller warts have been microscopically malignant. The malignant warts are larger than the benign and ulcerate both at the surface and at the base.

Cancerous ulcer of the lip can hardly be mistaken for any other lesion. Chancre of the lip is differentiated by the demonstration of spirochetes from the ulcer the Wassermann reaction, the acute character of the ulcer its occurrence at any age, and its response to antisyphilitic treatment.

Some epitheliomata of the lip are active from the start, some grow more malignant with time others increase in malignancy and then retrogress. Irritation of a malignant growth adds to its malignancy. Patients who are treated with pastes and plasters etc., do not get as good results as those who were not so treated.

The growths may be located on either side of the lip, in the middle line, and less commonly at the angles of the mouth.

Epithelial malignancies metastasize or are transferred to other locations by some of the malignant cells becoming separated from the primary growth and are carried by lymph vessels to the lymph-nodes, draining the involved area. Occasionally however they involve lymph-nodes distant from the affected area. The lymph-nodes act as a temporary barrier to the dissemination of this type of malignant growth. Ewing states "that the invasion of the lymphatics by malignant cells is greatly retarded or suppressed in malignant cases by extensive collection of lymphocytes, which gather in the vessels and may even surround the tumor as a lymphatic ring. Occasionally the entire tumor is infiltrated with lymphocytes, and in such cases the occurrence of many degenerating tumor cells indicates that the lymphoid infiltration is phenomenon of immunity. Lymphocytes and endothelial leukocytes are practically always

seen in the neighborhood of a cancerous growth. The fibrous tissue connective cell is also an important defense cell since it cuts off nourishment from the cancer cells.

The relation of the lymphatics draining the lip is an important factor in the prognosis and therapy of epithelioma of the lip. The lymphatics of the upper lip and lateral part of the lower lip end in the submaxillary glands. Both the deep and superficial lymph-vessels of the central part of the lower lip run to the submental glands. At times one or more of the lymphatic vessels pass to the deep superior cervical glands. In three fourths of the cases of epithelioma of the lip glandular metastasis is not demonstrable. The submaxillary lymph-nodes are the most common site of glandular metastasis less frequently the submental, cervical, and submaxillary salivary glands. The lymphatics of one or both sides may be affected the latter is more common in epithelioma located in the midline. It is well to remember that the submaxillary and submental nodes may be jointly the seat of malignant metastasis. Epitheliomata located at sides of the lip usually metastasize to the lymphatics of the affected side metastasis to the unaffected side, however may take place. Metastasis to other lymph-nodes (parotid jugular peritracheobronchial, inferior deep cervical) is not common in primary growths, but usually occurs in advanced cases of the disease and with recurrences. The positive finding of small hard nodes always means a less favorable prognosis.

It should be borne in mind that glandular metastasis may be present in the absence of palpable enlargement. The presence of indurated palpable lymph-nodes means well-advanced malignant disease.

Glandular metastasis may occur within three to six months after the appearance of the primary tumor. It is not uncommon however for glandular metastasis to be delayed until nine to twelve months after the appearance of the local growth.

As noted above palpation does not give an accurate index as to the presence of glandular metastasis. Every glandular enlargement must not be considered carcinomatous. The lymph-nodes may be enlarged as the result of bacterial infection before

cancer infection has invaded them. The diagnosis must, in every case be confirmed by histologic study. A small local growth may give rise to extensive metastasis and vice versa, i. e. a large local growth may exist with but little glandular enlargement. Extensive glandular metastasis is found in cases of recurrence after incomplete removal and with advanced malignancy.

Thiersch has stated that metastasis to the lymph-nodes is due primarily to an involvement of the mandible in the malignant process. This fact, however has since been shown to be a faulty interpretation. It is my custom to have an x-ray of the mandible taken in all cases of epithelioma of the lip.

The type of epithelioma which begins as a vesicle, seborrheic patch, or fissure is usually of slow growth late to metastasize and if metastasis does take place it is in easily accessible lymphatics.

The cases in which the malignant disease is so located that one-third or more of the lesion overlaps the mucocutaneous border even in the absence of palpable glandular involvement, often deceive the surgeon by their rapid metastatic development, within a few weeks or more after the primary growth has been successfully removed. All cases in which one-half or more of the malignant growth encroaches upon the mucous membrane offer an unfavorable prognosis. The prognosis is similarly unfavorable in cases of recurrence and where incomplete operation has been performed. The diagnosis in all cases is confirmed by histologic study.

Broder's studies indicate that the most important factor in squamous-cell epithelioma seems to be the degree of cellular activity. The cells of some epithelioma show a distinct tendency to differentiate, that is, to produce a growth similar to normal. In other squamous epithelioma there is no differentiation whatever. In a majority of the latter type of epithelioma of the lip there are many mitotic figures indicating high grade of malignancy. Broders has therefore, divided these epitheliomata into four grades according to differentiation and mitosis, special emphasis being laid on the former. This grading of 1 to 4

is independent of the clinical history. If an epithelioma shows a marked tendency to differentiate, that is, if about three-fourths of its structure is differentiated epithelium and one-fourth undifferentiated, it is Grade 1. If the undifferentiated and differentiated are about equal, it is Grade 2. If the undifferentiated epithelium forms about three-fourths and the differentiated one-fourth of the growth, it is Grade 3. If there is no differentiation of the cells, it is Grade 4.

Broders further states among the known causes of death, deaths from epithelioma were as follows: none of Grade 1, 54.90 per cent. of Grade 2, 84.21 per cent. of Grade 3, and 100 per cent. of Grade 4.

Treatment.—Successful treatment of this curable common form of cancer depends on two things: (1) the earliness with which the lesion is detected; (2) the thoroughness with which it is removed. As noted above, although the lesion may be detected early, within a few months of its onset, and no palpable glands present, if only the growth is removed glandular involvement is a frequent sequel. It is, therefore, urgently indicated in all cases to perform a complete surgical extirpation of the primary growth with all the glands in direct line for metastatic infection. Operation should be performed before metastasis to the lymph nodes is present. Glandular metastasis always means a less favorable prognosis. Obviously any habit or occupation acting as an irritant to the lower lip must be given up. A lesion or ulcer, as stated above, not responding to mild local treatment after removal of the cause of irritation must receive careful consideration as to operative intervention. Radium and x-ray are often curative in these so-called precancerous lesions. When the lesion is clinically suspicious of cancer, radical removal of the growth and the lymph nodes is urgently indicated and offers the best prognosis.

In the last few years fulguration has been widely used as a means of removing cancer of the lip. In precancerous lesions and in benign growths there is no doubt as to the efficiency of fulguration. I wish to mention the procedure particularly to condemn it absolutely as a routine method in the treatment of

malignant growths of the lip. In any epithelioma of the lip that has existed for say from three to six months, it is practically certain that the lymph tracts to the submental and submaxillary lymph-nodes are always microscopically infected with cancer even when not sufficiently enlarged to be palpable. Cancer of the lip is one of the forms of malignancy which, when taken early is probably curable by operation in 70 per cent. of cases. To merely destroy the growth on the lip is palpably futile. Surgery and radical surgery alone gives the best assurance of a cure that we have at our command at present.

Radium will undoubtedly cause the disappearance of epithelioma of the lip particularly when it does not involve the mucous membrane, but to depend upon radium alone is a procedure open to the same objections that apply to simple destruction by fulguration or to the excision of the old-fashioned V-shaped piece from the lower lip.

As an illustration of the inefficiency of treatment by fulguration alone, I wish to present a patient who in 1915 had an epithelioma of the lip destroyed by fulguration. One year later in November 1916 he came to me with not only an extensive recurrence of the growth on the lower lip but with a mass in the left side of the neck below the angle of the mandible that was clearly visible on the right side of the neck there was also a mass of large palpable glands. His condition was apparently hopeless. However at his request I operated upon him in November 1916.

I regard the Grant operation as the most useful operative procedure in cancer of the lip. In Grant's operation two vertical incisions are made, one on each side of the growth, and these are connected with a horizontal incision at the base which is usually about the crease between the chin and lip. Thus a quadrangular gap is formed which must be filled. An incision is made from the inferior angle of the wound obliquely downward and backward, on a line midway between the angle of that line and the apex of the chin or symphysis. Its further extension is determined by the amount of lip removed and by the degree of glandular involvement. All the submaxillary glands are re-

moved through these incisions. The removal of the submental glands, in the midline, beneath the chin, may require a separate incision. If the lip is extensively involved the cheek is completely separated from the inferior maxilla to the middle of the masseter muscle. When the glands have been removed the flaps are brought together and united, first of all in the middle line. If the tension is marked owing to the amount of tissue excised, one mattress suture is inserted, $\frac{3}{4}$ inch from the center line and tied over pads of gauze covered with oiled muslin to prevent soiling. This removes undue tension from the sutures in the center of the flap. The stitches that unite the cheek posteriorly are now inserted or if previously inserted are tied and the entire thickness of the cheek must be included. Silk worm-gut sutures are used. A small rubber tube should be inserted in the posterior angle of the wound on each side, to drain the mouth and for irrigation purposes. A T tube the size of a lead pencil should also be inserted through the submental space to the mouth beneath the tip of the tongue (Summers).

The stationary chin tissue is of the greatest importance as a point of fixation for the flaps. When half or more of the lip is removed the operation is completed and perfected by making an incision from each angle of the mouth backward and slightly downward, $\frac{3}{4}$ to 1 inch in length, down to the buccal mucous membrane, which is then separated from the overlying tissues above, below and posteriorly to the extent of $\frac{3}{4}$ inch. The lip above and below is beveled from the inner border in order to conform to natural conditions and also to make it easier to cover. The mucous membrane is now divided in the middle line and flaps united.

The operation that I do in advanced cases of epithelioma of the lip is that of Grant, as described above with the exception that the lateral incisions from the inferior angles of the lip incision are curved obliquely downward and backward well under the mandible and extended as far posterior as is necessary to secure room for the block dissection of the neck. From a point immediately anterior to the facial artery where the latter curves upward over the body of the mandible a perpen-

malignant growths of the lip. In any epithelioma of the lip that has existed for say from three to six months, it is practically certain that the lymph tracts to the submental and submaxillary lymph-nodes are always microscopically infected with cancer even when not sufficiently enlarged to be palpable. Cancer of the lip is one of the forms of malignancy which, when taken early is probably curable by operation in 70 per cent. of cases. To merely destroy the growth on the lip is palpably futile. Surgery and radical surgery alone, gives the best assurance of a cure that we have at our command at present.

Radium will undoubtedly cause the disappearance of epithelioma of the lip, particularly when it does not involve the mucous membrane, but to depend upon radium alone is a procedure open to the same objections that apply to simple destruction by fulguration, or to the excision of the old-fashioned V-shaped piece from the lower lip.

As an illustration of the inefficiency of treatment by fulguration alone, I wish to present a patient who in 1913 had an epithelioma of the lip destroyed by fulguration. One year later in November 1916 he came to me with not only an extensive recurrence of the growth on the lower lip, but with a mass in the left side of the neck below the angle of the mandible that was clearly visible on the right side of the neck there was also a mass of large palpable glands. His condition was apparently hopeless. However at his request I operated upon him in November 1916.

I regard the Grant operation as the most useful operative procedure in cancer of the lip. In Grant's operation two vertical incisions are made one on each side of the growth, and these are connected with a horizontal incision at the base which is usually about the crease between the chin and lip. Thus a quadrangular gap is formed which must be filled. An incision is made from the inferior angle of the wound obliquely downward and backward, on a line midway between the angle of that line and the apex of the chin or *symphysis*. Its further extension is determined by the amount of lip removed and by the degree of glandular involvement. All the submaxillary glands are re-

CLINIC OF DR. T. TURNER THOMAS

UNIVERSITY HOSPITAL

A METHOD OF APPLYING EXTENSION WITH PLASTER CAST FIXATION IN FRACTURES OF THE LEG

Of the American surgeons called to service during the war one will need to search for any not enthusiastically in favor of the Thomas splint and one or other of its associated methods of extension. Not being called into the service, I became responsible for an increased number of fractures and dislocations at home, and, therefore, without the special training and influence from those giving this training in the use of this admirable method of treatment. About three years ago I had the opportunity of observing its application by several competent surgeons, and at that time concluded that it was not as satisfactory as it has since proved itself to be.

Beginning my new work in fractures and dislocations with a distinct fear of infection non-operative methods were favored but it was soon evident that for cases with any considerable shortening and consequently overlapping of the fragments, the prevailing non-operative methods would not suffice. The test adopted for proving the efficacy of a method of overcoming the overlapping of the fragments was by x rays taken before and after the correction, and this led to an early abandonment of the old Buck's extension for fractures of the shaft of the femur and of the fracture-box for fractures of the leg when there was any considerable overlapping and shortening to be corrected. According to my observations the extension by Buck's method had little or no correcting influence in these cases, while the fracture box had none at all. The so-called "setting or reduction" of an overlapping fracture of both bones of the leg and maintenance of this reduction by a fracture-box, in my opinion, is almost an

dicular incision is made down the neck until it meets the anterior border of the sternomastoid muscle, above the clavicle. The skin being well reflected the entire glandular contents of the neck, from the symphysis of the mandible, as far posterior as the parotid gland and down to the clavicle, can be removed.



Fig. 85.—The full face appearance of the patient described in text four years after operation for recurrent epithelioma of the lip with extensive glandular involvement.



Fig. 86.—Profile view of patient shown in Fig. 85.

In the case of the patient referred to, and whose picture accompanies this article a portion of the floor of the mouth on the left side was removed both submaxillary glands, and other structures on both sides of the neck that could be removed by operation without irremediable damage were taken out. A new lower lip was constructed, still following the method of Grant. This patient to date, four years after the above operation, is in a splendid state of physical health.

methods of applying the traction to the foot indicate that no one of these methods enjoys general approval. As already stated, the powerful muscle contraction requires too much traction by any method for the comfort of the patient.

In the method here proposed the traction is applied to the foot by means of a plaster cast as has been done many times before, and as has been already discovered the foot will not easily tolerate the traction sufficient to overcome the deformity. My effort has been to remove the portions of the cast immediately overlying the points of greatest pressure thus compelling the remaining upper surface of the foot heavily padded with cotton to have the extending force generally distributed to it. The accompanying x ray evidence will show a fair if not good degree of correction of the deformity in the various fractures illustrated. It is of course, generally less than that obtainable by operation.

Two parts are distinctly essential and peculiar to the method, an ordinary wooden splint and a metal piece (iron has been used) which serves as a lever and fulcrum for the application of traction. For leg fractures the splint should be about 4 inches wide, 1 inch thick, and long enough to extend from 2 or 3 inches above the knee to about 18 inches below the foot. It is made as thick as an inch that it may stand the strain to which it is to be put later and about 4 inches wide, so that it may receive the weight of the limb comfortably and at the same time be narrow enough to permit the plaster cast to surround the limb snugly and take advantage of any bony prominences at the knee and ankle for the application of traction and counter traction. The excess of 18 inches below is to permit it to allow for the effect of the extension on the fracture during the application of which the splint is forced upward toward the trunk more than one would at first be inclined to expect. When the necessary extension has been obtained any useless length of the splint below can be sawed off.

The iron plate is the key to the whole method. Its purpose is to fix the leg in extension and if necessary increase the extension during the application of that part of the cast which is

impossibility because the powerful muscles in constant contraction from the irritation of the fragments and traumatic inflammation can be overcome only by a strong pull, and they will immediately reproduce the overlapping as soon as the pull is released.

One of the first methods tried was that of applying strong traction and countertraction by means of a Hawley table maintaining both by a plaster cast. Although the force applied was sufficient to cause a considerable area of superficial necrosis on the dorsum of the foot by the time the cast was removed, in about a week, it produced no appreciable effect in overcoming the overlapping of the fragments. The fracture was then plated. In another case, a young man with some atrophy of the limb from infantile paralysis and very little fracture deformity the traction applied had no correcting effect on the slight overlapping fragments, but the cast was not removed for eight weeks, when union was firm. The method was discarded.

Having some time before the war conceived the germ of a method and having tried it in various forms with partial success the increased clinical material led soon to the development of a plaster cast method of applying traction and fixation, especially to fractures of the leg, and with less satisfaction to those of the thigh. A modification of the principle was tried in forearm fractures, but with less satisfaction than in those of the femur. The traction was applied at one sitting under a general anæsthetic, preferably ether. It has the great objection common to all non-operative methods which depend upon traction and countertraction. The degree of force necessary to overcome the contraction of the powerful muscles upon which the shortening and overlapping of the fragments depend is so great that the patient frequently complains. The Thomas splint originally depended on the Buck adhesive plaster method with the Spanish windlass principle for regulating the degree of traction. The popularity of the ice-tongs traction is due to its more direct and effective pull on the lower fragment while the continued use of the Buck extension and Spanish windlass and the introduction of the Sinclair skate and the continued use of other

to cover especially the upper surface of the dorsum of the foot and heel, the two ends of the layer being made to cross each other on the dorsum to give additional protection there where most of the traction pressure will be felt. Holes are to be cut later here and under the upper surface of the heel and the cotton picked out until the undue pressure is relieved. A few turns of a plaster bandage are now used to encase the foot and plate



Fig. 88.—The splint, heavily padded with cotton is placed under the limb with its upper end just below the knee-joint and the lower end projecting below the foot. A thick layer of cotton is placed in front of the lower part of the knee where the counterpressure will be most felt. The splint and limb from the upper end of the splint to the lower end of the cotton placed in front of the knee will be covered by flannel bandage in preparation for the plaster covering shown in Fig. 89.

making the turns snug enough to prevent this portion of the cast from being pulled over the heel by the traction to be applied to it later and the cast strong enough to stand the strain. The foot should be held at right angles to the leg while the plaster is being applied, and the upper edge of the cast should have a generous layer of cotton between it and the skin to prevent the cutting of this edge of the cast into the skin when the traction is being applied.

The wooden splint is now covered by a layer of cotton 5 or

to maintain the traction afterward and immobilize the fracture. It should be about 2 inches wide 12 inches long, and $\frac{1}{2}$ inch thick. Its lower end is extended into a point which serves to catch firmly in the wooden splint and act as a fulcrum for maintaining the traction while the fixing portion of the cast is being applied. This point has been made about $\frac{1}{2}$ inch long and about as wide where it becomes continuous with the body of the plate. It should be beveled to the point on one side. This will permit



Fig. 87—Application of the plaster cast of the foot. Such is to hold the metal plate. Note the heavy padding with cotton, especially on the dorsum of the foot and above the heel. Note also that the cast will permit motion at the ankle.

it to take a firmer hold of the splint if the plane surface is turned upward and the beveled surface downward toward the lower end of the splint.

This iron plate is first applied to the plantar surface of the foot, as shown in Fig. 87 with a thin layer of cotton between it and the foot and a similar thin layer of cotton on the outside of the plate so that it can easily be removed after the whole cast has been satisfactorily applied and has hardened. A layer of cotton about 3 or 4 inches thick is then wrapped around so as

to cover especially the upper surface of the dorsum of the foot and heel, the two ends of the layer being made to cross each other on the dorsum to give additional protection there where most of the traction pressure will be felt. Holes are to be cut later here and under the upper surface of the heel and the cotton picked out until the undue pressure is relieved. A few turns of a plaster bandage are now used to encase the foot and plate



Fig. 88.—The splint, heavily padded with cotton, is placed under the limb with its upper end just above the knee-joint and the lower end projecting below the foot. A thick layer of cotton is placed in front of the lower part of the knee where the counterpressure will be most felt. The splint and limb from all but the upper end of the splint to the lower end of the cotton placed in front of the knee will be covered by flannel bandages in preparation for the plaster covering shown in Fig. 89.

making the turns snug enough to prevent this portion of the cast from being pulled over the heel by the traction to be applied to it later and the cast strong enough to stand the strain. The foot should be held at right angles to the leg while the plaster is being applied and the upper edge of the cast should have a generous layer of cotton between it and the skin to prevent the cutting of this edge of the cast into the skin when the traction is being applied.

The wooden splint is now covered by a layer of flannel.

6 inches thick which will be compressed by the leg as shown in Fig. 88. When the leg is placed on the splint the upper edge of the latter should extend 2 or 3 inches above the knee. Extra cotton should be employed to make up for the diminishing diameter of the lower part of the calf of the leg. A generous layer of cotton should be placed also over the lower part of the knee as shown in Fig. 88 where the counterpressure will be most felt. A flannel bandage is then used to cover the limb

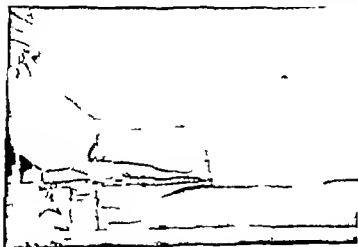


Fig. 89—Shows the two disconnected segments of the cast in position, hardened, and the extension being applied. The two hands of the surgeon are seen grasping the metal plate above and below the foot and applying the traction, the countertraction being effected by the pressure of his knee against the lower end of the splint. A tick has been eliminated from the picture.

and splint from 5 or 6 inches above the upper end of the splint to the lower part of the knee or about where it joins the calf as indicated in Fig. 89 where it is shown covered by a substantial thickness of plaster cast. It now becomes necessary to wait until the plaster material hardens, usually until the following day, and as the foot has not yet been fixed to the wooden splint it must be supported and prevented from falling to one side or the other. A sand-bag on each side and both tied to

the leg or a fracture-box pushed upward under the splint as far as it will go and the sides of the box properly padded and tied together will suffice.

When the plaster cast is sufficiently hardened to stand the strain and the patient is anesthetized preferably by ether the traction is applied and the cast completed. The most responsible part of the procedure is the determination and application of the necessary degree of traction. This responsibility belongs to the surgeon in charge of the case. He will be surprised to learn how much traction can be applied in an ordinary overlapping fracture of the leg without overcoming the overlapping entirely. He will learn too that traction alone will not usually place the fractured surfaces in apposition and that in some cases in which there is an excessive tendency of the lower part of the leg to curve inward the lateral displacement will be increased by the traction. With the end of the splint extending below the end of the table and the splint resting on the table directly not as in Fig 89 during the photographing of which it was elevated for illustrative purposes the surgeon grasps the iron plate above and below the foot as shown in Fig 89 places his knee against the lower end of the splint and makes what he believes is enough traction to overcome the overlapping and holds it by sinking the end of the metal piece into the wooden splint, fixing it more firmly by driving the point of the metal into the wood by a hammer or anything which answers the purpose. If he inclines the iron plate so that the point is directed toward the lower end of the splint as much as possible and the opposite end directed toward the knee, he may add further traction when the point is fixed in the splint by pulling downward on the upper end of the splint as far as he thinks it justifiable (see Fig 90). The degree of traction applied will depend upon the personal equation, as well as upon the resistance offered by the contracted muscles.

When the proper traction has been applied it is held by the metal piece until the rest of the cast is on and hardened when the traction will have been transferred to the cast. The best method of completing the cast can hardly be said to have been es-

established. Figure 91 shows the metal piece maintaining the traction while the cast is being completed. My present procedure is to first cover the leg and splint by a flannel bandage in the interval in which the leg is bare down to the end of the cotton padding, or to within 6 or 8 inches of the ankle and then apply the plaster connection between the two previously disconnected casts beginning below the knee and including the leg and splint as far down as the end of the cotton padding between the leg and splint. From this point down the flannel bandage was made to pass between the leg and splint and the plaster bandage likewise as shown in Fig. 91. This will give a more direct and



Fig. 91.—When the desired traction has been applied the pointed lower end of the metal plate is driven into the ankle for fixation. Further traction may still be applied by pulling downward on the upper end of the plate as indicated in this illustration. It may be an advantage to hock the plate so that its point is nearer the lower end of the splint than the traction on the upper end of the plate. It brings the foot to right angle with the leg for fixation by the cast.

solid continuity between the two previously separated parts of the cast and later will permit removal of the part covering the upper surface of the heel without losing much of the traction on the foot. After this has been done the plaster bandages are passed around the ankle, foot, and leg above and the splint below without any effort to pass them between the limb and splint. If one is not careful he will find later that in applying this part of the cast he has forced the heel uncomfortably close to the splint and the patient will complain of a pain or burning of the heel due to pressure of the heel on the splint. It may compel removal of the cast. If it is only a light piece of muslin

bandage passed under the heel and tied to a stand of some kind placed over it, as for keeping off the weight of the bedclothes



Fig. 91.—The traction has been applied, the point of the metal plate has been caught in the splint and hampered down for better fixation, and the connecting portion of the cast is being applied. The bare portion of the leg including the seat of fracture has been covered by flannel bandage and this by plaster material. Note that the plaster surrounds the leg and splint to within 6 or 8 inches of the ankle and from this point down encloses the limb only including enough of the foot and knee casts to make good connection between these two previously disconnected portions of the cast. This plaster connection plays a very important part in maintaining the extension when the pull on the metal plate is released. Note the mark made by pen and ink under the heel. This indicates the portion of the cast to be removed later for relief of pressure on the heel, and is shown here because it will be covered in the finished cast. The hands of the surgeon have been so placed here, correcting lateral displacement of the fragments, to emphasize the importance of correcting any displacement at his stage during the extension. The x-ray will show the direction in which to make the pressure and it should be borne in mind that too much pressure can hardly be made. Undercorrection is more likely to take place.

will lift the heel from the splint enough to give the needed relief. The surgeon will determine for himself how to apply this last portion of the cast so that it will be strong enough to take

the strain of the traction from the metal piece which can afterward be removed. I have no definite way of applying the turns of the plaster bandage but keep in mind what it is necessary to accomplish, and apply the turns successively until the object is accomplished which is determined when the cast has sufficiently hardened and takes the strain when traction on the metal piece is released.

Figure 92 shows an opening in the cast over the dorsum of the foot about 3 inches long and 1½ inches wide made to relieve

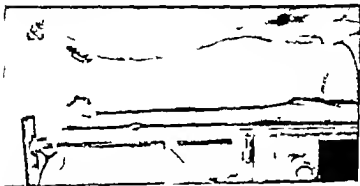


Fig. 92—Shows the finished cast with opening for the release of pressure here it does most harm. On the opposite side is an opening similar to the lateral one shown and both are made to facilitate the removal of the portion of the cast under the heel and marked in Fig. 91. The purpose is to so apply the bandage that it will hold the foot in the position fixed by the metal plate. The excess of splint below has been removed. The traction is maintained by the metal plate until the cast is hard enough to take the strain. Foot making any creaking or crackling in the cast.

pressure here where it is likely to do the most damage and give most distress if it is not relieved. It will usually be found if the extension has been severe enough to overcome the overlapping of the fragments, that the skin is bloodless when exposed through such an opening. By picking away the cotton and lifting the still soft margins of the opening in the plaster this pressure should be gradually lessened until the skin becomes pink or red showing a good circulation. Otherwise there will

likely be sloughing here later. On the side and near the splint can be seen another opening of about the same size through which the plaster covering the upper surface of the heel was cut away while it was still soft and before the pressure here has time to do permanent damage. A similar opening is made on the opposite side in the corresponding situation to aid in making the deeper opening above the heel. The outline of one side of such an opening was marked with a pen on the cast shown in Fig 91. Cotton may be picked away here also until one is satisfied that this portion of the heel is relieved of pressure. When the patient recovers from the effects of the ether he may complain and compel still further relief of pressure. It is not claimed that this will prove to be an easy, safe, and always successful method of treating these troublesome fractures but one that will require care in the application and much study to avoid errors. There would be no particular difficulty in applying sufficient traction and manipulation to obtain a good reduction of the deformity in most cases if we could ignore the effects of the traction on the foot. That it can accomplish fairly good reduction the accompanying illustrations show and it can be said that the complaints of pain and distress can be largely overcome by attention to the above methods of relieving pressure.

War experience proved perhaps more than anything else in surgery the value of extension in fractures of the long bones. The successive devices employed for the application of the extension proved that there were difficulties associated with it. My own feeling is that we are not quite ready for a standardized method of treatment, although we have come nearer to an efficient standard in the Thomas method than we have ever come before. The method with Buck's extension and sand bags or other lateral splinting came close to being a standard method for years, but would not now be considered an efficient one. I feel also that the open reduction and direct fixation of the fragments is only temporarily in eclipse. From the extreme conservatism of the Buck and similar methods the pendulum swung to the extreme in the opposite direction, *i. e.* to open reduction and direct fixation of the fragments. It has of late gone back to the conservative side but not quite as far as at

first. We are taking somewhat more risk with the ice-tongs and giving more discomfort by the greater pull of the newer methods of extension. I believe it will swing over to the operative side again, but not go as far as on the first swing. The operative treatment has not yet become obsolete. The great advantage of the non-operative treatment is avoidance of infection, but it probably never will give as good anatomic results as the operative method. The functional result will depend more upon the anatomic result than upon any other factor.

Discontent in my early efforts with the anatomic results of non-operative methods led to a trial of the open method. They were so good that the temptation was to increase the number of operations. Then came a supracondylar T fracture of the femur with some additional comminution in which non-operative methods failed to accomplish any correction of the deformity and operation was done through two incisions, one over the internal and the other over the external condyle. Failing to adjust satisfactorily the internal condylar fragment which was attacked first, the external incision was made and the external fragment was adjusted with difficulty and plated, but when the internal wound was again exposed the internal condylar fragment was seen protruding from the wound and almost completely detached. Replacement and adjustment of this fragment was found impossible, and it was removed. Both wounds were closed without drainage and a dressing and plaster cast were applied. No signs of infection occurred and the cast was not removed for seven weeks, when a small sinus was found with a slight discharge. It is my present belief that this merely indicated that not enough time had elapsed for the complete filling in by granulation tissue of the cavity left by the removal of the big condylar fragment, and that removal of the cast and dressings led to infection. Long-continued efforts to close the sinus failed, the fragments and joint became infiltrated with pus, and finally amputation above the knee was done. A few months later in August, 1919 a chronic alcoholic, nearly fifty years of age jumped from a second-story window while intoxicated, and sustained a comminuted fracture of the upper third of the femur including fractures of greater and lesser trochanters. The adjust

ment of the fragments by open operation proved difficult and prolonged. Infection followed and the patient died in about a week.

These 2 cases almost decided me against the open method, at least for nearly all cases, but my whole experience for the preceding year with the exception of these cases, had been so good that it was concluded to try again and to exclude particularly comminuted fractures of the femur and patients of suspiciously poor nutrition. My records for the past twenty six months show 34 fractured femurs operated on and 4 fractures of the neck of the femur in which wood screws were passed through the fragments. In every case the wound was swabbed thoroughly with dichloramln T just before closing and a plaster cast applied from the pelvis to the foot always including the pelvis and usually the foot. In 2 cases a second operation was done for a broken Sherman vanadium steel plate. I did the second operation in one case and both in the other. In a third case a second operation was done for bending of the bone after weight bearing was allowed, the Parham Martin bands having been employed. Except in the two in which the broken plates were removed and the third in which the bands were taken out, in not one (barring of course the 2 cases referred to above) was a cast removed until union was considered complete or the wound reopened for any purpose. In not one was there any sign of infection not even stitch infection. It has not been possible to make in the available time a satisfactory examination of the records for other fractures operated on. There were probably close to as many operations done on all other fractures as were done for fractured femurs, but except in one case of fracture of both bones of the leg there was not as much as one stitch infection, and in no other case was a plate or any other fixation material removed. In the one fracture of the leg mentioned, because of the absence of signs of infection the plaster cast was not removed for six weeks, when a small sinus was discovered with slight discharge, on account of which the plate and screws were removed and the wound left open for healing. Union had not occurred but the fragments were in excellent position and united later with a practically perfect result. Such results should in my opinion, influence one in favor of further trial and not of discarding operation.

In all of the cases here illustrated by x-ray plates, except in one femur fracture (Plate III Fig 5) and one leg fracture (Plate IV Fig 11) the method of extension with plaster cast fixation was employed. The particular manner of employing the method in fractures of the femur has not been offered because neither the method of application nor the results were considered sufficiently satisfactory. The difference in results is evident in the illustrations. One reason for the difference is as follows: Traction alone did not seem to bring the fragments into sufficiently good alignment so that direct pressure on the fragments was employed. While the traction was being applied and before the region of the fracture was covered with the plaster and while it was being covered very vigorous pressure was applied by the hands (as shown in Fig 91) on each fragment in the direction necessary for correction of the deformity as shown by the x-ray. Over correction in fractures of the leg seemed to be impossible regardless of the degree of corrective force applied. This did not apply with the same force in the fractures of the middle of the shaft, but seemed to apply to the supracondylar fractures as shown in Figs. 8-98. My present inclination is to favor this method for the non-operative correction of fractures of the shafts of the tibia with or without fracture of the fibula, and the Thomas splint and ice-tongs traction for the femur fractures, although I have a strong inclination toward the open method for clean-cut simple fractures in healthy young persons particularly for fractures of the femur. There has gradually developed in the past two years and a half a confidence in the operative technique and the avoidance of infection not unlike that which most of us feel concerning the danger of infection following operation on a clean case of appendicitis. It may prove later that this feeling of confidence is not justified but so long as it lasts one is justified in trying to prove that it is justified.

COMMENT ON CASES ILLUSTRATED BY SKIAGRAPHS

Plate III Fig 1 Severe traction was necessary to obtain the degree of correction shown here which was considered sufficient to render operation unjustifiable. Some separation of the fragments and consequently lengthening of the limb is evident

here. Only perfect approximation of the fragments could prevent some lengthening.

Plate III, Fig 2 The successive pictures in this case are all anteroposterior views. The lateral views showed little deformity and were eliminated. *A* shows the original deformity before the correction. *B* After first attempt at correction. *C* After second attempt. After each of these two attempts the limb at the site of fracture was not enclosed in the cast, so that vigorous manipulation could be made in the efforts to correct the displacement. Repeated attempts were fruitless nor could the deformity be detected by palpation owing to the tension on and consequent rigidity of the overlying muscles. A comparison of the corresponding portions of both fragments will show that normal length was obtained in the first attempt and slight overlengthening in the second. Therefore it is not right to assume correction of the displacement because the shortening has been nearly or quite overcome. *D* shows correction by open method.

Plate III, Fig 3 Anteroposterior views alone showed displacement, and consequently the correcting influence of the traction and manipulation of the fragments. *A* Before and *B* after correction, or rather overcorrection. Strong union was obtained and excellent alignment of the whole limb. The fracture occurred in June, 1920. Measurement of the two limbs in November showed slightly more than $\frac{1}{4}$ inch lengthening of the affected limb.

Plate III Fig 4 Such comminution makes operative fixation difficult and infirm. The fracture occurred in March, 1920. The union is firm and the alignment of the whole limb excellent. Measurements of both limbs recently showed $\frac{1}{4}$ -inch lengthening of the affected limb.

Plate III Fig 5 In this case the Thomas splint and ice tongs traction were employed two weeks after the fracture occurred. The correction was accomplished in from two to three weeks, but eight weeks after beginning this treatment union had not occurred. Because of the period at which the extension was applied a longer time for union will be necessary. *A* shows anteroposterior view before correction. *D* after correction. *C*

In all of the cases here illustrated by x-ray plates, except in one femur fracture (Plate III Fig 5) and one leg fracture (Plate IV Fig 11) the method of extension with plaster cast fixation was employed. The particular manner of employing the method in fractures of the femur has not been offered because neither the method of application nor the results were considered sufficiently satisfactory. The difference in results is evident in the illustrations. One reason for the difference is as follows. Traction alone did not seem to bring the fragments into sufficiently good alignment, so that direct pressure on the fragments was employed. While the traction was being applied and before the region of the fracture was covered with the plaster and while it was being covered very vigorous pressure was applied by the hands (as shown in Fig 91) on each fragment in the direction necessary for correction of the deformity as shown by the x-ray. Over correction in fractures of the leg seemed to be impossible regardless of the degree of corrective force applied. This did not apply with the same force in the fractures of the middle of the shaft, but seemed to apply to the supracondylar fractures as shown in Figs. 87-88. My present inclination is to favor this method for the non-operative correction of fractures of the shafts of the tibia with or without fracture of the fibula, and the Thomas splint and ice tongs traction for the femur fractures, although I have a strong inclination toward the open method for clean-cut simple fractures in healthy young persons, particularly for fractures of the femur. There has gradually developed in the past two years and a half a confidence in the operative technique and the avoidance of infection not unlike that which most of us feel concerning the danger of infection following operation on a clean case of appendicitis. It may prove later that this feeling of confidence is not justified, but so long as it lasts one is justified in trying to prove that it is justified.

COMMENT ON CASES ILLUSTRATED BY SKIAGRAPHS

Plate III Fig 1 Severe traction was necessary to obtain the degree of correction shown here which was considered sufficient to render operation unjustifiable. Some separation of the fragments and, consequently, lengthening of the limb is evident

here. Only perfect approximation of the fragments could prevent some lengthening.

Plate III, Fig. 2 The successive pictures in this case are all anteroposterior views. The lateral views showed little deformity and were eliminated. *A* shows the original deformity before the correction. *B* After first attempt at correction. *C* After second attempt. After each of these two attempts the limb at the site of fracture was not enclosed in the cast, so that vigorous manipulation could be made in the efforts to correct the displacement. Repeated attempts were fruitless, nor could the deformity be detected by palpation owing to the tension on and consequent rigidity of the overlying muscles. A comparison of the corresponding portions of both fragments will show that normal length was obtained in the first attempt and slight overlengthening in the second. Therefore it is not right to assume correction of the displacement because the shortening has been nearly or quite overcome. *D* shows correction by open method.

Plate III Fig 3 Anteroposterior views alone showed displacement, and consequently the correcting influence of the traction and manipulation of the fragments. *A* Before and *B* after correction, or rather overcorrection. Strong union was obtained and excellent alignment of the whole limb. The fracture occurred in June, 1920. Measurement of the two limbs in November showed slightly more than $\frac{1}{4}$ inch lengthening of the affected limb.

Plate III Fig 4 Such comminution makes operative fixation difficult and infirm. The fracture occurred in March 1920. The union is firm and the alignment of the whole limb excellent. Measurements of both limbs recently showed $\frac{1}{4}$ inch lengthening of the affected limb.

Plate III Fig 5 In this case the Thomas splint and ice-tongs traction were employed two weeks after the fracture occurred. The correction was accomplished in from two to three weeks, but eight weeks after beginning this treatment union had not occurred. Because of the period at which the extension was applied a longer time for union will be necessary. *A* shows anteroposterior view before correction. *D* after correction. *C*



Ray pictures of fractures of thigh.



Ray pictures of fractures of leg

shows lateral view after correction. The corresponding view taken before traction was applied did not include the seat of fracture.

Plate IV Fig 6 This patient was a very heavy woman, and the problem of obtaining in such a case a good anatomic and functional result presented special difficulties. Ten weeks after the accident she is beginning to take the weight on that limb and the prospects seem good.

Plate IV Fig Only the anteroposterior views are shown because the lateral views show good allinement of the fragments and little deformity. Consequently they would not show the correction. The same is true of Plate IV Fig. 10 *A* Before and *B* after correction.

Plate IV Fig 8 *A* and *B* Anteroposterior views before and after. *C* and *D* lateral views before and after correction.

Plate IV Fig 9 Fractures as transverse and irregular as this one are difficult of correction because they call for a considerable overcorrection of the shortening to permit the irregularities of each fragment to pass each other for complete adjustment. The *C* plate shows less overlapping than the *A* plate, which was one of those taken before any attempt at correction, because the *C* plate was taken after an attempt at correction and after some of the overlapping had been overcome, the original lateral view having become mislaid.

Plate IV Fig 10 No fracture of the fibula is shown in these plates. This, however does not completely exclude such a fracture as it might have occurred above the highest part of the fibula shown in the plate.

Plate IV Fig 11 This child was about four years old too young for ice-tongs and rather too young for the extension cast method, which requires some toleration of discomfort in the early stages following its application. The degree of deformity was enough to call for correction, so that an incision was made to the fracture, with as little disturbance of the tissues as possible, the fragments were adjusted, grasped with a pair of bone forceps, and a small nail driven through both to prevent the muscles from reproducing the deformity. The particular difficulty with this method was connected with driving the nail in the right direction and selecting a nail that was not too long or too short.

CLINIC OF DR. JOHN H. JOPSON

PRESBYTERIAN HOSPITAL

OLD FRACTURE OF THE PATELLA. TREATMENT BY OPEN OPERATION WIRING OF THE FRAGMENTS AND SUTURE OF THE FASCIA AND APONEUROSIS

THIS patient, an active heavily built man thirty-eight years of age, received severe injuries in a motor accident in April, 1920 sustaining fractures of the sternum ribs, and right patella. He was treated in another hospital, and no operation was performed for the fractured patella, but splinting and later the application of plaster casts was resorted to. He now presents himself five months after the accident, with non-union of the patellar fragments and a practical disability of the limb. On examination, he is observed to walk with a well-marked limp, and uses a cane at all times. He has complete loss of the power of extension of the knee, can only swing it forward, and cannot balance himself on the affected limb. The two large fragments are freely movable and can be approximated by pressure when the limb is extended (Fig 93-1). When the knee is flexed they are separated by a distance of 2 inches, and the condyles of the femur can be palpated between them. There is evidently only a thin layer of fascia connecting them which is too wide and attenuated to transmit any extensor action to the lower fragment or lend any stability to the limb. In view of the disability which prevents him from pursuing his vocation of a traveling salesman, his comparative youth, and good physical condition, an operation is strongly indicated.

The operation which we prefer in these cases is similar to that which is employed by us in recent cases of fracture of the patella, with such modifications as are necessary to secure

apposition of the freshened fragments, where they cannot be approximated easily by reason of contraction of the quadriceps muscle, as in injuries of long standing. The opportunity to employ it is seldom offered at the present time, when the great majority of recent fractures of this bone are subjected to early operation, with the most gratifying results. For example of about 30 fractures of the patella operated by us in civil life only 1 was an example of non-union, and this was of about two years standing. One was a case of compound fracture the remainder were simple recent fractures. During this same period a few cases of patellar fracture were seen and treated in which operation was not indicated by reason of the fact that they were examples of simple fracture the result of direct violence, without tear of the aponeurotic covering and lateral expansions, and without consequent separation of the fragments. Such cases in our experience heal readily and with strong and bony union by fixation alone. The great majority of fractures of this bone are the result of indirect violence, sustained in falling and with few exceptions call for operative intervention. The safety of this is shown in our series, which was without mortality and without joint infection. In 2 or 3 cases there was a limited superficial infection of the subcutaneous fat.

In this case we make the usual curved incision downward (Fig 93 2) and the flap so formed is lifted with forceps, exposing the fragments connected by a broad thin sheet of fascia. We proceed with the usual technic employed in joint and bone cases, avoiding the introduction of the gloved hand in the wound and using the forceps technic for sponging and handling of the tissues as far as is practicable. The fascial covering is divided but not resected being spared to assist in the reconstruction of the covering ligaments. The fractured surfaces of the patellar fragments, covered with connective tissue are exposed (Fig 93 3). This covering is resected with sharp scissors, and the condensed underlying bony surface further cut away with bone forceps, thus vivifying the areas to be united. Approximation of the fragments in this instance is easy. In a former case of non-union, operated after much longer interval and in a patient

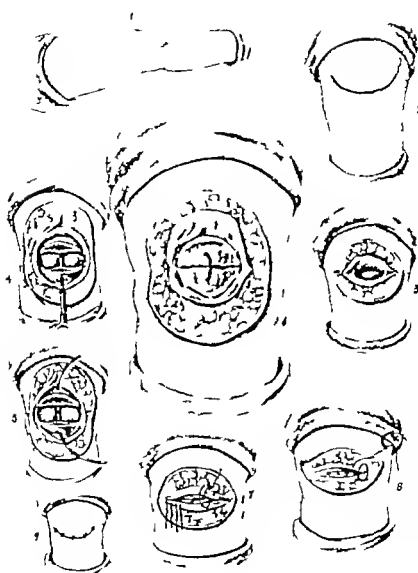


Fig. 93.—Old ununited fracture of the patella. Operation, wiring and suture.

who had suffered repeated traumatism, the fragments could not be brought together at this stage. In that instance we first did a plastic lengthening of the quadriceps tendon, and shortened by a considerable distance the gap separating them, but still they could not be apposed. We then proceeded to a subperiosteal resection and elevation of the tibial tubercle after the plan of von Bergmann, nailing it to the tibia at a higher level, after which the lower fragment could be attached to the upper one. In that case we achieved a very satisfactory result. In this patient we need no such technic, but proceed to drill and wire the fragments prepared by freshening. We still stress the use of silver wire fixation even in recent patellar fractures. By its use we believe we maintain a more secure fixation and approximation of the broken surfaces immediately and for a longer period during the process of repair than by the more popular technic of suture of fascia and aponeurosis alone. Furthermore, we have less hesitation in removing the splint early and encouraging the patient in the active mobilization of the joint, which is the keynote of modern postoperative joint therapy. Of course, no permanent strength is added to the bone by the presence of the wire after union is obtained, but we have never had to remove the wire in any of these cases as silver wire is well tolerated by bone and we have seen it heal in in drained cases of fractured long bones where it has been used for temporary fixation. In the recent case we drill the holes so as to bring the wire out on the fractured surface but where great tension is likely to be thrown on it, as in old cases and those of refracture, we penetrate the entire thickness of the bone, to insure against cutting through when the wire is twisted tight (Fig 93 4). After passing the wire (Fig 93 5) the joint cavity is carefully cleansed washed with ether the wire suture tightened and the fragments snugly fastened by twisting it (Fig 93 6). Suture of the fascia and the aponeurotic expansions, using a heavy chromic catgut, and utilizing the fascia which had united the fragments is then carried out and in this case a deep layer of mattress suture and a superficial row of continuous stitches give an added strength to the repair (Fig

93 7 8) The skin wound is then closed without drainage (Fig. 93 9) and a splint applied

The postoperative care will consist in fixation of the joint for five weeks, a much longer period than in recent cases, in which the splint can be removed in two weeks, as a longer time will be needed to favor the bony union which we hope to obtain. When the splint or cast is removed active movement of the joint is directed. This is best done with the patient sitting or recumbent. While flexing the knee he assists himself by lifting the thigh with the hands while the heel rests on the bed. These movements are practised by the patient himself several times a day in the same manner as we direct in the treatment of wounded and infected joints, and as taught by Willems. Passive movements of stiff and partially ankylosed joints are far inferior in efficacy and after-results to the active efforts of the patient himself who always stops short of actual and injurious trauma to the synovial throes, which often results when the surgeon resorts to the so-called 'breaking up of adhesions' a most injurious practice. Full weight is not placed on the limb for several weeks longer and no risks taken of falling and breaking the recent union

who had suffered repeated traumatism, the fragments could not be brought together at this stage. In that instance we first did a plastic lengthening of the quadriceps tendon, and shortened by a considerable distance the gap separating them but still they could not be apposed. We then proceeded to a subperiosteal resection and elevation of the tibial tubercle after the plan of von Bergmann, nailing it to the tibia at a higher level, after which the lower fragment could be attached to the upper one. In that case we achieved a very satisfactory result. In this patient we need no such technic, but proceed to drill and wire the fragments prepared by freshening. We still stress the use of silver wire fixation even in recent patellar fractures. By its use we believe we maintain a more secure fixation and approximation of the broken surfaces immediately and for a longer period during the process of repair than by the more popular technic of suture of fascia and aponeurosis alone. Furthermore, we have less hesitation in removing the splint early and encouraging the patient in the active mobilization of the joint, which is the keynote of modern postoperative joint therapy. Of course, no permanent strength is added to the bone by the presence of the wire after union is obtained, but we have never had to remove the wire in any of these cases, as silver wire is well tolerated by bone and we have seen it heal in in drained cases of fractured long bones where it has been used for temporary fixation. In the recent case we drill the holes so as to bring the wire out on the fractured surface but where great tension is likely to be thrown on it, as in old cases and those of refracture we penetrate the entire thickness of the bone, to insure against cutting through when the wire is twisted tight (Fig 93 4). After passing the wire (Fig 93 5) the joint cavity is carefully cleansed washed with ether the wire suture tightened, and the fragments snugly fastened by twisting it (Fig 93 6). Suture of the fascia and the aponeurotic expansions, using a heavy chromic catgut and utilizing the fascia which had united the fragments, is then carried out and in this case a deep layer of mattress sutures and a superficial row of continuous stitches give an added strength to the repair (Fig

ECTOPIC TESTICLE: PERINEAL VARIETY OPERATION AND IMPLANTATION OF TESTICLE IN THE SCROTUM

This patient is a well-developed boy of eight years who since birth has presented this condition of abnormal descent of the right testicle. Examination shows that the right side of the scrotum is empty is smaller than the left side, and that in the perineum, to the right of the median line, is a movable body the size of the testicle, which admits of a considerable range of motion and can be pushed forward to the spine of the pubes, and backward almost as far as the anterior border of the anal opening. There are no evidences of a hernia on either side.

This case offers an example of one of the varieties of abnormal migration or descent of the testis. The testicle may be arrested at any point in its normal route from the abdomen, constituting some one of the forms of undescended testicle or it may occupy one of three locations entirely abnormal in relation to its normal position in intra uterine life or after birth. These latter forms are grouped under the head of ectopia testis. The present case is one type of ectopia and, while not common is encountered more frequently than the others. The three types of ectopus are the perineal, where the testis is found in the perineum the crural, where it descends to the thigh through the femoral canal and the pubopenile, where it is located in the pubopenile region and beneath the sheath of the penis. Both of the last two forms are very rare.

It may be stated in a general way that any condition of abnormal descent or migration of the testis is a source of possible danger in future life to the individual exhibiting it. An abnormal location of the organ outside the abdomen exposes it to repeated traumatism which may lead to further atrophy of the already poorly developed gland, and which certainly offer every theoretic predisposition to the development of malignant disease. As to the proportion of cases of misplaced testicle

In this case, where simple transplantation is required we begin our incision as for inguinal hernia, and carry the lower end through the scrotofemoral crease into the perineum. The inguinal canal is laid open, and the cord is observed to turn downward over the spine of the pubes into the perineum where we find the testicle of normal size and development, and attached by a short, strong ligament to the tissues immediately in front of the anterior wall of the rectum. No hernia is present. The attachment of the testis to the deep structures of the perineum is divided freeing it and the cord. The right side of the scrotum is opened by blunt dissection the testicle placed in it, and the distal end secured by sutures passing through the tunica vaginalis and the bottom of the scrotum. As the scrotum is underdeveloped on this side, and the testicle tends to slip upward and be crowded out, we pass a purse-string suture through the tissues at the mouth of the scrotum above the cord (Bevan technic) and as an additional security suture the margin of the cord to the structures in the same neighborhood by a single stitch (Dowd sutured it to the pillars of the external ring in operation for undescended testicle). The canal is closed in the usual manner without disturbing the cord at this point, and of course without transplanting it. The operation is concluded by suture of the skin in the usual manner.

which develop such malignant disease there has been much discussion, and there is a wide diversity of opinion, but we are convinced that they exceed the percentage observed in the normally placed organ. Replacement of the testicle in the scrotum before puberty gives the best chance possible for development, which rarely occurs when it remains in the abnormal position. In at least 60 per cent. of cases of arrested migration there is an associated hernial sac, and while strangulation is rare, it occasionally occurs, and as the pressure of a truss cannot be borne, operation is indicated on this ground as well. From six to twelve years is the most favorable time for the operation, as the structures are rather small for satisfactory work before the earlier age, and to leave the operation until after puberty is a great mistake, for the reasons already stated.

The operation for ectopic testicle of this type offers no great difficulty as the cord is of ample length to permit the transplantation of the testicle in the scrotum. In the commoner cases of arrested descent the operation which Bevan has standardized is now generally adopted, with such occasional modifications as the individual case may demand. Some of the modifications which have been suggested, as Davison's, for example, for lengthening the cord, are valuable in the exceptional case, but the operation as originally described will be found efficacious in the great majority of cases. It is seldom necessary for example, to divide the spermatic vessels to bring the testicle to a satisfactory level in the scrotum, but some writers have laid great stress on this detail, claiming that it was an essential part of the technic. It rarely results in gangrene of the testicle although this sometimes occurs. Even without this slight risk, it is poor policy to cut down the blood-supply of an organ which we wish to develop by dividing the spermatic vessels and trusting to the artery of the vas to furnish the nutrition. It should never be done unless it is absolutely necessary. We have emphasized this point before and added experience has convinced us of the fact that it is seldom necessary if all strands of connective tissue, of peritoneal sac above the testicle, and of attached cremaster are separated and divided

PRIMARY HEMANGIOMATOUS ENDOTHELIOMA OF THE SPLEEN SPLENECTOMY

THE patient is an Italian woman, thirty three years of age admitted to the hospital eight days ago with the following history

She is married and the mother of 4 living children, having lost one with influenza. She had always been well until five months ago when she discovered a lump under the left costal margin, the size she says of a lemon. At the same time she began to suffer with upper abdominal pain radiating to the right kidney region which kept her awake at night. The tumor kept increasing in size, and while she has not much pain at present, she states she cannot sleep on the right side. She has lost much weight she says 100 pounds, although this seems excessive suffers with daily headaches, and has little appetite. For some time her skin has had a yellow tinge.

Physical examination shows a marked emaciation and the appearances of pronounced anemia. The chest examination is negative, as is that of the nervous system. Abdominal examination demonstrates a hard nodular tumor in the left upper quadrant, which extends a full handbreadth below the costal margin, almost to the navel and quite to the median line. It moves with expiration and with change of posture, and by its contour and location is readily recognized as an enlarged spleen.

Laboratory findings are as follows: Urine, 1030 acid no albumin or sugar a few epithelial and white blood-cells. Blood Wassermann negative R. B. C. 2,450,000 W. B. C. 14,800 Hemoglobin 46 per cent. Differential count Polys. 53 per cent. large lymphocytes, 4 per cent. small 38 per cent. large mononuc. 1 per cent. trans. 2 per cent. baso. 2 per cent. Anisocytosis marked microblasts moderate numbers megaloblasts 0 poikilocytosis, marked polychromatophilia, marked Malarial parasites none. Fragility of R. B. C. partial hemolysis, 0.4 per cent. saline complete hemolysis 0.3 per cent.

likely to slow absorption of clot from the bed of the spleen. On September 26th, five days after operation, blood examination showed R. B. C., 1,980,000 hemoglobin, 43 per cent. October 1st. R. B. C., 2,280,000 W. B. C. 15,200 hemoglobin, 55 per cent. October 8th R. B. C., 2,800,000 W. B. C. 8600 hemoglobin, 55 per cent. Anisocytosis, poikilocytosis, very slight, no nucleated R. B. C.

After subsidence of fever convalescence was rapid and normal. She left the hospital on October 30th, and was not seen again until November 22d, when she was found to be doing well, gaining in weight and strength, and with her anemia greatly improved. A blood count taken on this date showed R. B. C. 4,780,000 W. B. C. not taken hemoglobin, 83 per cent. color index, 0.86 polya. 76 large lymph. 6 small lymph. 16 tr 2 anisocytosis slight poikilocytosis very slight. Nucleated R. B. C. none seen. Polychromatophilia a few cells basophilic degeneration none.

The report of the pathologist to the hospital is appended. Dr. Nelson F. Percy whose experience in the surgery of the spleen is very large, saw this patient during her convalescence, and examined the specimen and the histologic slides. He informs us that he has had but one case which was similar to this, of an undiagnosed type, which developed a polycythemia after splenectomy having had a mild secondary anemia before operation. After operation the red blood-cells rose to 10,000,000 the patient suffered a variety of nervous and other symptoms and the condition was only kept under control by using him for a donor on several occasions, after which there was an improvement which promised to be lasting.

Pathologic Report by Dr. John Elman, Pathologist to the Hospital.—Spleen weighs 1590 gm. and measures 22.5 x 16.5 x 7.5 cm. (Fig. 94) The upper pole is bent on itself. The spleen is firm in consistency. The external surface over the upper third is covered with dense fibrous adhesions. The remaining surface of the spleen is fairly smooth however it shows here and there irregular small patches of zuckerguss and a few scattered fibrous adhesions. Over the areas where there are no adhesions

Phenolsulphonaphthalein elimination 1 Amount, 80 c.c., P. S. P., 15 per cent. 2 Amount, 60 c.c., P. S. P. 10 per cent.

A second examination of the blood yesterday gave practically the same findings.

Dr. John H. Mueser, Jr., has examined the patient, and is inclined to consider the case as one of Banti's disease in the second stage. In view of the patient's nationality the possibility of malarial enlargement is also borne in mind. In any event, splenectomy is indicated.

Our incision is a straight one to the left of the median line through the rectus muscle and sufficiently long to give an ample exposure, and room for our manipulations. The spleen, much enlarged and curved on itself is quite firmly attached by adhesions, especially on its outer surface and upper pole, to the diaphragm, stomach, and under surface and outer edge of the left lobe of the liver. These adhesions are gradually separated by the hand, and without exciting much hemorrhage, until the viscus is freed and rotated inward when the pedicle is accessible to ligature. The splenic artery is tied first, then the veins, and the spleen removed. A raw surface on the edge of the liver oozes and requires the application of several catgut sutures to check the hemorrhage. The cavity left is wiped dry and the wound closed. The patient leaves the table after operation, which has been conducted under morphin, gas, and ether in fair condition. 650 c. c. of normal saline solution has been instilled under the breasts during the operation. The pulse at the conclusion is 132 having been 100 at the beginning. 1 grain of camphor is given hypodermically.

The after-history of this patient is not without interest. Her condition the same evening was precarious, and the weak pulse shallow respirations, and air-hunger were sufficient to indicate a blood transfusion, which was carried out by Dr. Speese, the donor being the patient's brother. The reaction to the same was prompt and satisfactory. Her convalescence was marked by a temperature which subsided in a week, but rose again and persisted for two weeks longer and was due either to a limited area of pulmonary consolidation, or as seemed more

likely to slow absorption of clot from the bed of the spleen. On September 26th, five days after operation blood examination showed R. B. C., 1,980,000 hemoglobin, 43 per cent. October 1st. R. B. C. 2,280,000 W B C 15,200 hemoglobin, 55 per cent. October 8th R. B. C. 2,800,000 W B C., 8600 hemoglobin, 55 per cent. Anisocytosis, poikilocytosis, very slight, no nucleated R B C

After subsidence of fever convalescence was rapid and normal. She left the hospital on October 30th, and was not seen again until November 22d, when she was found to be doing well, gaining in weight and strength, and with her anemia greatly improved. A blood count taken on this date showed R. B. C., 4,780,000 W B C not taken hemoglobin 83 per cent. color index, 0.86 polya., 76 large lymph., 6 small lymph., 16 tr 2 anisocytosis slight, poikilocytosis very slight. Nucleated R. B. C. none seen. Polychromatophilia, a few cells basophilic degeneration none.

The report of the pathologist to the hospital is appended Dr Nelson F Percy whose experience in the surgery of the spleen is very large, saw this patient during her convalescence, and examined the specimen and the histologic slides. He informs us that he has but one case which was similar to this, of an undiagnosed type, which developed a polycythemia after splenectomy having had a mild secondary anemia before operation. After operation the red blood-cells rose to 10,000 000 the patient suffered a variety of nervous and other symptoms, and the condition was only kept under control by using him for a donor on several occasions, after which there was an improvement which promised to be lasting

Pathologic Report by Dr John Elman, Pathologist to the Hospital.—Spleen weighs 1590 gm. and measures 22.5 x 16.5 x 7.5 cm (Fig 94) The upper pole is bent on itself The spleen is firm in consistency The external surface over the upper third is covered with dense fibrous adhesions. The remaining surface of the spleen is fairly smooth however it shows here and there irregular small patches of *zuckerguss* and a few scattered fibrous adhesions. Over the areas where there are no adhesions

and no "ruckergum" the capsule shows no thickening. Here and there are seen through the capsule ill-defined firm yellow



Fig. 94.—Hemangioendothelioma of the spleen. On the left is seen the cut section, showing the yellow area. Yellow in color in the specimen, representing connective-tissue replacement.

ish areas which vary in size from a pin-point to 2 cm. in diameter. Over some of these areas the surface is lightly raised.

The anterior border shows three notches, the deepest of which measures 3 cm.

It cuts with increased resistance. The cut surface bulges. It is mottled, grayish to dark red with very irregular yellowish areas scattered throughout. The yellowish areas vary in size from a split pea to 3.8 cm in diameter. They are hard and woody in consistency and show no evidences of encapsulation. In their distribution and relation to the capsule they do not resemble infarcts, but appear to be neoplastic in character.



Fig. 93.—Section from hard, yellow area. Hyalinized connective tissue with calcareous infiltration and deposits of hemosiderin. (Low power.)

The grayish areas are fairly firm and fleshy in consistency. They are ill-defined and vary in size from a pinhead to 2.2 cm. in diameter. The reddish portions have the consistency of fairly firm splenic pulp.

Microscopic.—Capsule shows areas of thickening and hyalinization of connective tissue. Also shows fibrous adhesions. The architecture of the spleen is disarranged; definite follicles and cords cannot be made out. Sections from the hard yellow areas (Fig. 93) show irregular masses of dense connective tissue



Fig. 96.—Section from reddish area showing irregular blood spaces lined with polygonal cells. (Low power)



Fig. 97.—High power of Fig. 96.

which shows hyalinization and deposits of calcium salts and fairly large amounts of amorphous fine dark brown pigment most likely

hemoiderin. The sections from the reddish portions (Figs 96-97) show numerous somewhat irregular blood spaces which vary greatly in size. Most of them are filled with red cells and lined with large polyhedral or spindle-shaped cells which show large vesicular nuclei. These cells proliferate outside the walls of the vessels, forming diffusely disseminated tumor masses of varying size. Sections from the grayish areas (Fig. 98) show solid tumor



Fig. 98.—Section from grayish area showing solid tumor composed of roughly spindle-shaped cells and moderate numbers of giant-cells. (Low power)

masses composed of roughly spindle-shaped cells with vesicular nuclei. They show no definite arrangement. Here and there are seen a few giant cells. The tumor masses show no evidence of encapsulation.

Diagnosis.—Hemangiomatous endothelioma of the spleen. (The yellow hard areas probably represent areas in the neoplasm which have undergone retrograde changes and connective tissue replacement.)

CLINIC OF DR GEORGE P MULLER

UNIVERSITY HOSPITAL

LARGE ENCHONDROMA OF SCAPULA OF MANY YEARS' DURATION EXCISION OF TUMOR AND SCAPULA FOLLOWED BY LOCAL RECURRENCES

THE first case which I wish to show you is an example of a large enchondroma of the scapula.

J T Age forty-six. Printer by trade. Since a boy exact date unknown, he has had a mass on the shoulder over the



Fig 99—Enchondroma of scapula

scapula, but it was not until four years ago that it began to grow progressively larger. He was admitted to the St. Agnes Hospital May 14 1918 (Figs. 99 100). On May 18th under ether

anesthesia, I removed the tumor and scapula. The operation was prolonged, but he reacted well. On June 26, 1918 the wound was entirely healed. The pathologic report (Dr. John Fenz) was as follows: Specimen No. 3399 is a large three-lobed mass, 26 cm. in its greatest diameter by 24 by 20 cm. Exterior surface is red except an area 12 cm. square, which is attached skin. This upper surface is concave to conform with underlying thoracic contour. Tissue cuts with a fibrous resistance, and knife grates on hard material at parts. Cut surface is

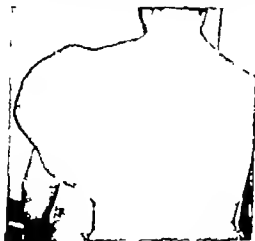


Fig. 100 —Enchondroma of scapula, posterior view

Irregular granular and mottled, pearly white at certain areas. At one portion of mass glenoid fossa of scapula appears, with the overhanging acromion process, body of scapula is lost in the tumor mass. Tumor mass weighs 4820 gm.

Histologic sections reveal the tumor to be made up of cartilage, which is mostly of the hyaline variety although areas are found composed of fibrous tissue. Calcific infiltration is present at many portions. Islands of cartilage are surrounded by fibrous tissue. No mitotic figures are present in the chondroblasts. Histologic diagnosis Chondroma with calcareous in-

filtration, evidently of periosteal or perichondrial origin, from scapula.

In the summer of 1919 he noted a small mass was present in the posterior axillary region at the lower end of the scar. This slowly increased in size, and on December 3, 1919, he was admitted to the University Hospital, when the mass was found to be free movable nodular and about 8 cm. in diameter. Under nitrous-oxid oxygen anesthesia it was dissected out (December 4, 1919). The wound healed by primary union.

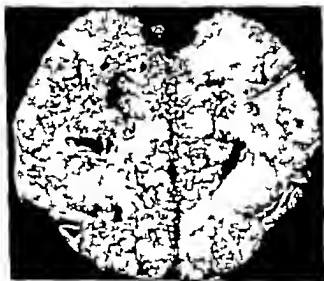


Fig. 101.—Enchondroma of scapula, section surface of recurrent scar. Large original tumor except that latter had fibrous tissue.

After discharge the patient later stated that he noted a little lump high on the shoulder. We did not detect it, however. It grew rapidly and in August, 1920, had attained a large size. He was readmitted, and at the base of the neck a large mass, hard, movable and nodular was found wedged behind the clavicle. Again under nitrous oxid-oxygen anesthesia (August 5, 1920) the mass was exposed and removed. It was ad

herent to the clavicle and the chisel was used at this point. The wound healed. The pathologic report follows. Specimen (Fig 101) consists of an oval-shaped tumor measuring 20 x 10 x 10 cm and weighing 510 grams. It is well encapsulated, hard in consistency nodular and cuts like cartilage showing a white retracted lobulated interior with some irregular areas of softening the consistency and appearance being that of carti-



Fig 102 —Low power microphotograph of enchondroma same

lage. Microscopic examination shows cartilaginous tissue (Fig 102)

An enchondroma is a rather common tumor and is usually located in the diaphysis of the long bones. A number of cases have been reported as occurring in the scapula and Deganello has collected 39 cases. Some of them have attained huge proportions, and one weighed 17 pounds. It will be noted that our specimen weighed about 10 pounds. The growth arises from any part of the bone and presents the characteristic ap-

pearance and microscopic evidence of cartilaginous tissue, often with mucoid degeneration. Some are chondrosarcomas, in which case recurrence or metastasis to the lungs will be found to be the rule.

I frankly admit that this case was suspected to be sarcomatous by reason of the later rapid growth, and for this reason no attempt was made to save the glenoid cavity of the scapula. Consequently he lost the use of the muscles attached to the scapula but the man, a printer is no more deformed than before the operation, when the growth itself interfered with the use of the shoulder and scapular muscles.

ENCHONDROMA OF SCAPULA AND LONG BONES (MULTIPLE CARTILAGINOUS EXOSTOSES)

SOMEWHAT allied to this case is the following. The patient is eighteen years of age, and when ten years of age first noticed a small, hard nodular growth on the right scapula which has been progressively increasing in size. Three years later she also

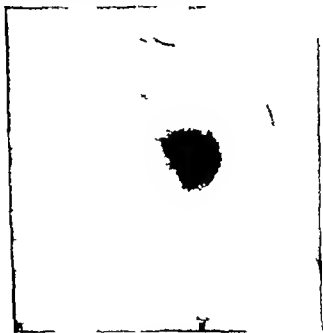


Fig. 103.—Small enchondroma on scapula. Patient had multiple lesions.

noticed a hard lump in the right popliteal space. A little later a mass appeared below the right knee and also on the phalanges of the hands.

There is nothing significant in the previous history. She had measles, and when seven years old was struck by lightning,

being rendered unconscious for about five hours. In addition to the demonstrable growths you will notice that there is an enlargement of each epiphyseal region. The Wassermann reaction is reported negative. On October 21, 1919, at another hospital (St. Agnes) I chiselled off the mass on the scapula (Figs. 103-104) and the one in the popliteal space (Fig. 105) which was attached to the femur. She now returns suffering with some pain in the region of the right knee, but refuses further operative interference.

This case may be considered as one of multiple cartilaginous exostoses. A very large literature has arisen about this



Fig. 104.—Enchondroma of scapula. Specimen removed from patient with multiple lesions. Was about 1 cm. in length.

disease, and it is often termed hereditary deforming chondroplasia, a history of heredity being obtained in about 50 per cent. of the cases. Honeij (Archives Int. Med. 1920, 23, 534) in a recent paper collects 66 reported cases. He found the bones affected in the following order of frequency: The femur was affected in 43 cases, tibia in 35 cases, humerus in 29 cases, fibula in 27 cases, radius in 25 cases, ilium in 24 cases, phalanges in 20 cases, ribs in 19 cases, scapula in 17 cases, pelvic bones in 13 cases, clavicle and metacarpal in 12 cases each, metatarsal bones in 6 cases, skull bones in 6 cases, knee in 4 cases, the spine and tarsal bones in 2 cases each, and the sternum in 1

case. Hony studied 2 cases from the standpoint of metabolism, and suggests that in the early stages a check may perhaps be given to the progress of the disease by proper dietary procedure.

Many of the cases in the literature do not distinguish between the multiple cartilaginous exostosis and the mechanical

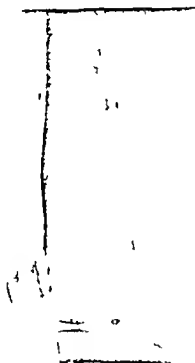


Fig. 103.—Osteochondroma of femur. Patient had multiple lesions.

or traumatic exostosis. Elliot reported an interesting case before the American Surgical Association last year and believes that following contusion of bone the extravasated blood collects beneath the periosteum and may be the starting-point of a more locally growing pointed exostosis.

CHONDRO-OSTEOMA OF HUMERUS IN YOUNG BOY (DEVELOPMENTAL EXOSTOSES RESEMBLING SAR- COMA)

This boy (Fig. 106) was admitted to my service in another hospital (Misericordiae) in October 1919 with the following history When about three years old a hard mass was first



Fig. 106 — Osteochondroma of humerus in boy

noted in the upper arm and attached to the bone. It gradually increased in size since but has never caused pain or other symptoms except interference with the free motion of the muscles. It was diagnosed as a sarcoma by several physicians in the boy's home town and amputation advised. It was a typical osteoma, however and conservative measures believed proper. The growth was on the inner and posterior aspect of the left humerus just below the axillary fold (Fig. 107)

Under ether anesthesia the tumor was exposed and found to be attached to the humerus by a narrow pedicle. This was

1587



Fig. 107—Osteochondroma of humerus. Developmental exostosis

chiseled through close to the shaft and the mass easily enucleated from the surrounding muscles without enlarging the

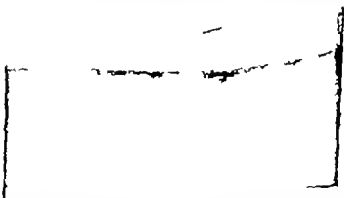


Fig. 108—Appearance of humerus after removal of osteochondroma. The pathologist, Dr. Paul, reported the tumor to be an osteochondroma.

MULTILOCULAR CYST (ADAMANTINOMA) OF LOWER JAW TREATED BY SIMPLE EXCISION AND FOLLOWED BY CURE FOR A PERIOD OF THREE YEARS

I HAVE always been interested in the epithelial odontomas, and the next patient is an example of this affection, presenting many interesting features. He is a physician by occupation, and stated that fifteen years previously he had a wisdom tooth



Fig. 109 - Early appearance of adamantinoma in the jaw

extracted. As more or less pain persisted he consulted an oral surgeon three or four years later but was told the matter would soon clear up. In 1911 an x-ray picture was taken and an impacted root of a wisdom tooth noted. Nothing else was said

about the x-rays. In 1917 more x rays were made, but nothing definite was determined, although later examination of these plates (Fig 109) revealed a suspicious shadow. In January 1918 he was examined by Dr G. E. Pfahler (Fig 110) who referred him to me, and a definite diagnosis of adamantine epithelioma made.

The operation was performed in the University Hospital February 5 1918 under ether anesthesia. The jaw-bone was exposed and perforated with a gouge chisel. A cyst was en-

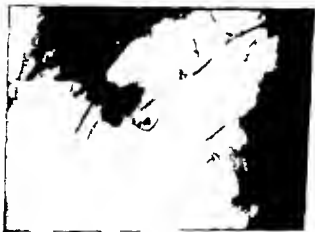


Fig. 110.—Honeycomb appearance of growth in jaw one year later than pictured in Fig. 109.

countered containing a brownish, solid material. The entire roof of the cyst was removed with rongeur forceps and a communication found with another cyst. As the operation continued about six of these cysts were encountered, the final opening extending nearly to the tip of the coronoid. All cavities were thoroughly opened up, curetted and the bone smoothed with the burr. The bone was then thoroughly cauterized and disinfected with iodine. The wound healed well.

The pathologic examination was made by Dr. Spence and sections in each fragment showed several small cysts lined by

stratified squamous epithelium and more or less completely occupied by closely packed cells of the same type. These occur in a loose fibrocellular connective tissue of indeterminate source. They may well represent epithelial penetrations in the deeper gum tissue, with secondary cyst development in the penetrating epithelial roots (Fig 111)



Fig 111—Lower power microphotograph of cystic epithelial growth (adamantinoma)

In September 1918 Dr Pfahler reported finding the angle of the jaw and the general jaw bone healthy (Fig 112) The patient has remained perfectly well.

One of the simplest classifications of these cystic tumors of the jaw is that of Wohl (Annals of Surgery 1916 64 672) He divides them into A. Inflammatory cysts (dental and root cysts) B Tooth germ or choroblastomatous cysts.

The latter are subdivided into (a) the unilocular cyst commonly known as the dentigerous or follicular cyst (b) multilocular cyst, conventionally designated as adamantine epi-

theloma, multilocular dentigerous cyst and () the solid tumor

A somewhat different classification was adopted in the Report of the Committee of the British Dental Association in 1914. The main divisions were (1) epithelial odontomas, where the abnormal development takes place in the dental epithelium alone (2) composite odontomas, where the abnormal development takes place primarily in the dental epithelium and secondarily in the dental papilla and may occur in the follicle



Fig. 112. Radiograph of jaw seven months after operation.

also and, (3) connective-tissue odontomas, where the abnormal development takes place in the dental tissues of mesoplastic origin alone. The multilocular cyst is classed in the first group.

The adamantinomas are most frequently seen in the lower jaw and are usually situated at the angle. They may occur at any age, the average in Lewis' (Surg. Gyn. Obs. 1910: 10: 25) collection was thirty-three. Several theories have been advanced for their occurrence but the most popular is that of Malassez (1885) who states that they are due to an overgrowth

of the rudimentary paradental epithellum. An excellent description will be found in Ewing's book on Neoplastic Diseases.

In the case shown the jaw was only slightly enlarged and at operation appeared 'honeycombed' by the growth. In the larger tumors reported in the literature the cysts were large and filled with fluid. In a few cases the cyst resembles a dentigerous cyst (unilocular) but the adamantine lining could be demonstrated. The solid areas consist of masses of spheroidal epithelial cells arranged in layers or alveoli and with a degenerating center. The outer layer may be typically columnar and the inner composed of stellate cells corresponding to the enamel pulp.

The diagnosis rests on the slow growth, the absence of teeth over the part involved and the x-ray appearance of the multilocular cyst. The latter was typical in this patient. Care must be taken at the time of operation to differentiate a sarcoma. You will find that, as a rule, radical extirpation is advised by means of a resection of the jaw because of the fear of recurrence. In this patient the cavities were followed up with the chisel and curet, and to destroy any outlying particles I used the actual cautery. The patient has been free from recurrence for three years, and the result justifies the conservative measure employed. In very large cysts with a thinned maxilla I believe that resection and later bone transplantation would be indicated.

